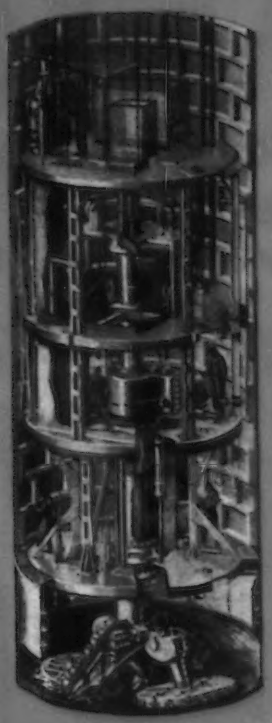
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

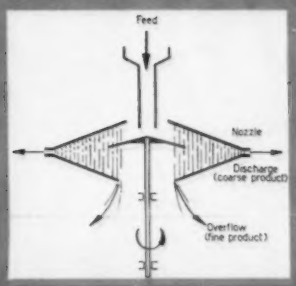
AUGUST 1959

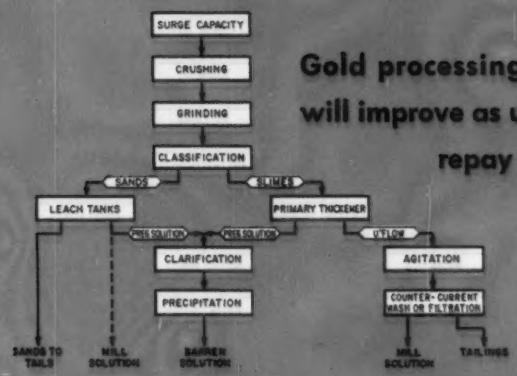
PRICE ONE DOLLAR

FOUNDED 1866



Solid-Liquid separation—Mr. Fontein concludes his survey of techniques. p 101





Gold processing techniques will improve as uranium men repay a debt. p 95

Soviet's huge sinking stage grinds, mucks and sets lining. p 89

Canada and the U.S. dedicate a new shipping artery: iron ore is the keystone. p 82

THESE RECORDS challenge equal performance in iron-ore pumping

1 WASHING PLANT

8 operating pumps (14″x 12″ D-6-5 Hydroseals)
1,800,000 tons handled per pump
Total distance — 19,000 feet
Time — 3½ years
Total parts-replacement cost — $0.00228 per ton

2 SPIRAL-MAGNETIC SEPARATING PLANT

4 operating pumps (14″x 12″ D-6-5 Hydroseals)
1,160,000 tons handled per pump
Time — 16 months — 24 hours a day, 6 days a week
Not a single part replaced

Over fifty 14″x12″ D-6-5 Hydroseal split-shell rubber-lined pumps are operating with top efficiency. These economy records in the iron-ore field typify the superior performance of other A-S-H pumps in all operations. Write us about your particular pumping problem.

For information about Hydroseal split-shell rubber-lined pumps, write us for our illustrated Brochure No. 457.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

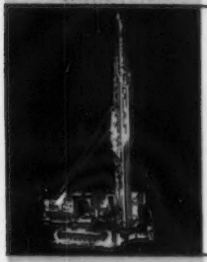
HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

A Constant Standard of Quality in

EVERYTHING YOU NEED FOR DRILLING ROCK

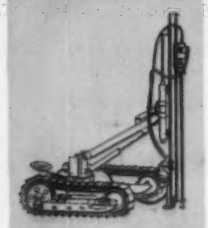
DRILLMASTERS

The most productive and versatile primary blast-hole drill ever developed. Completely self-powered and self-propelled. For rotary drilling or percussion drilling with the revolutionary I-R Downhole drill.



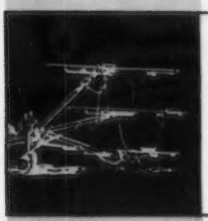
QUARRYMASTERS

The **big** blast-hole drilling rig for heavy-duty service in mines or quarries. Completely self-powered and self-propelled. Can be used as a percussion drill or rotary drill simply by interchanging drill units.



CRAWL-IR DRILLS

The most rugged and completely mechanized crawler drill obtainable. All drill-tower motions hydraulically controlled, converting setup time into drilling time. Tows its own portable air compressor.

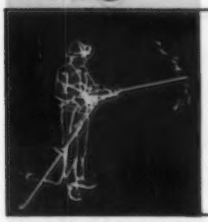


HYDRA-BOOM DRILLING RIGS

Mechanized rock drilling at its rugged best. Heavy-duty hydraulic booms and power-feed drifters for tractor, truck or jumbo mounting. Save manpower—increase production—cut drilling costs.

WAGON DRILLS

Versatile and powerful wheeled units, manually adjustable for drilling in any position. Heavy-duty FM-4 Wagon Drill and light-weight JHM Wagonjack.



UNIVERSAL JACKDRILLS

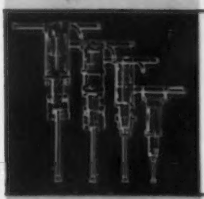
The first completely integrated Jackleg drill ever developed. Telescopic feed leg gives full 6-foot feed from an easily-handled 3-foot leg. Five-position throttle and roll-type feed leg valve simplify operation.

VACUJET STOPERS

The **dustless** I-R stoper drill with built-in jet suction and pressure discharge for fast, clean roof bolting jobs. Only a canvas bag dust collector needed. Use with I-R carset bits and I-R carburized drill steel.

DUAL-DRILL RIGS

Suspended from a side boom tractor, the Dual Drill Rig drills two holes at a time in any trench pattern. Rugged framework mounts dual heavy-duty drifters with long feed. Ideal for pipeline and trench drilling.



JACKHAMERS

A complete line of hand-held percussion drills. A size, weight and drilling power to meet the specific requirements of any job to best advantage. Known the world over for stamina and dependability.

CARSET BITS

The tungsten-carbide insert bit pioneered and perfected by Ingersoll-Rand. High sustained drilling speed in any type of ground. Shoulder drive, bottom drive or tapered socket bits in sizes from 1¼" to 4". Downhole-drill bits from 4¾" to 9".

PAVING BREAKERS

The most complete line of demolition and digging tools available. Six basic sizes, from heavy-duty R-30 slag breaker to light-weight J-10 utility tool. Also a complete line of precision made accessories.

AIR COMPRESSORS

From the world's largest manufacturer of Compressors;—Gyro-Flo portable air compressors from 85 cfm to 900 cfm—Stationary air compressors from 1 hp to 6000 hp.

AIR-LINE LUBRICATORS

Assure proper lubrication for longer life and reduced maintenance of all air-powered rock drills and paving breakers. Operate in any position—automatically feed right amount of atomized oil into air line.

BIT AND ROD SHOP EQUIPMENT

Bit grinders, shank grinders, steel cutters, steel sharpeners and bit and rod furnaces, designed and built by rock drill experts. Everything you need for a well-equipped bit and rod shop.

Your I-R representative is a skilled specialist with wide experience in every phase of rock drilling. Call him whenever you want assistance or advice.

Ingersoll-Rand

5-949

11 Broadway, New York 4, N. Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR ROCK DRILLING

ENGINEERING AND MINING JOURNAL

93rd YEAR OF PUBLICATION

AUGUST 1959

VOL. 160 NO. 8

Behind the By-Lines	4	Operating Ideas	110
EM&J Outlook	19	Patents	112
Markets	24	This Month in Mining	20
New Products Digest	43	Washington Impact	22

The Jets—A 4-H Club for the Engineering Profession 81

St. Lawrence Seaway—New Avenue for Canadian & U.S. Mine Output 82

Soviet Shaft Borer Has Unique Head ..... B. Shavkun 89

The Price of Copper, 1960-1975 ..... William P. Shea 91

Gold Plants of the Future—Lessons from Uranium . . . R. H. Raring & G. Y Murray 95

Solid-Liquid Separation Techniques, Part II ..... F. J. Fontein 101

Plan '59—Modernize Machinery for Growth & Profits 114

Donald C. McGraw Jr. ..... Publisher

Alvin W. Knoerr ..... Editor

Daniel P. Eigo ..... Managing Editor

John B. Huttl ..... Associate Editor San Francisco

Lloyd E. Antonides ..... Associate Editor

James W. Franklin ..... Associate Editor

Finn B. Domaas ..... Assistant Editor

David S. Smith ..... Assistant Editor

George H. Cleaver ..... Market Editor

John R. O'Connell Jr. ..... Associate Editor Markets

F. Alvin Zimmerli ..... Art Director

John Donaldson ..... Washington Bureau, Natural Resources

Alan E. Adams ..... Washington Bureau, Labor

William H. McNeal ..... Circulation Mgr.

Raymond H. Smalley ..... Business Mgr.

News Bureaus: Atlanta 3; Chicago 11; Cleveland 15; Dallas 1; Detroit 26; Houston 25; Los Angeles 17; San Francisco 4; Seattle 3; Washington 4.

World News Bureau: London, Moscow, Bonn, Paris, Rio de Janerio, Mexico City, Beirut, Tokyo, Melbourne. **World News Offices:** Stockholm, Manila, Buenos Aires, Caracas, Havana, Lima, Santiago, Montreal, Toronto, Vancouver, Johannesburg.

Published monthly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1918), founder. Publication Office: 3rd & Hunting Park Ave., Philadelphia 40, Pa. See panel below for directions regarding subscription or change of address.

Executive, Editorial, Advertising and Subscription Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, president; Joseph A. Gerardi, executive vice president; L. Keith Goodrich, vice president and treasurer; John J. Cooke, secretary. Officers of the Publication Division: Nelson L. Bond, president; Harry L. Waddell, senior vice president; Ralph B. Smith, vice president and editorial director; Joseph H. Allen, vice president and director of advertising sales; A. R. Venezian, vice president and circulation coordinator.

Subscriptions are solicited only from executive management, engineering operating and supervisory officials associated with companies engaged in the exploration, mining, milling, smelting, refining and processing of metals and nonmetallic minerals except coal oil and stone. Position and company connection must be indicated on subscription orders. Send to address shown in box below.

Subscription rates for individuals in the field of the publication: United States and possessions $4 a year; $6 for two years single copy $1. Canada $5 a year; $8 for two years; single copy $1. Other Western Hemisphere and Philippines $8 a year; $12 for two years; $16 for three years; single copy $2. Elsewhere $15 a year; $25 for two years; $30 for three years; single copy $2.

Second-class postage paid at Philadelphia, Pa. Title registered in the U. S. Patent Office.

© Copyright 1959 by McGraw-Hill Publishing Co., Inc. All rights reserved. Printed in the U.S.A. Our primary aim is to provide subscribers with a useful and valuable publication. Your comments and suggestions for improvement are encouraged and will be most welcome. The publisher upon written request from any subscriber to our New York office, agrees to refund the part of the subscription price applying to copies not yet mailed.

SUBSCRIPTIONS: Send subscription correspondence and change of address to Fulfillment Manager, ENGINEERING & MINING JOURNAL, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Since copies are addressed one or two issues in advance, please allow one month in sending notice for the change to become effective.

Postmaster: Please send form 3579 to Engineering and Mining Journal, 330 W. 42nd St., New York 36, N. Y.

B.F.Goodrich

All B.F.Goodrich Grommet V belts are double-matched at no extra cost

B.F.Goodrich V belts now have 40% greater horsepower rating

All B.F.Goodrich V belts now have 40% greater horsepower rating. This higher capacity rating was formerly found only in high capacity belts, but now costs *no more than former standard belts.* This means that lighter, more compact, and lower cost drives can now be used, because these B.F.Goodrich belts carry the horsepower needed for efficient drives using fewer belts at standard belt prices. And all B.F.Goodrich Grommet belts are double-matched.

Double matching assures you that a set of B.F.Goodrich V belts are of equal length when installed and will stay uniform in length for the life of the belts. When V belts of different lengths are put on the same drive, longer belts loaf, while shorter ones carry all the load and fail quickly. B.F.Goodrich double-matched belts are measured *twice* for uniform length, once when manufactured and again after storage. Only belts that are of equal length when manufactured and after storage are grouped into sets.

Grommet construction is exclusive in B.F.Goodrich V belts. Grommets are two extra strong cord loops, inside the belts, like twisted cables, except they are endless. Unlike ordinary belts, there are no center cords in the Grommet belt, so it is more flexible, can "give" temporarily and absorb shock loads.

Let your B.F.Goodrich distributor show you how this higher capacity, longer belt life, ability to stand hard use, can reduce your V belt costs per year and make other savings in operating and maintenance costs. *B.F.Goodrich Industrial Products Co., Dept. M-667, Akron 18, Ohio.*

B.F.Goodrich *V belts*

Behind the By-Lines...

Someone had suggested light summer reading for this issue. We're sorry, but our highly-informed writers and correspondents just can't be turned off. There's enough meat in the following pages to supply barbecues for the entire season.

Item: An interesting compilation of the techniques which uranium mill men once borrowed from the gold industry, and which they're now eager to return—with improvements clear down the line. p 95

Item: An analysis of the copper market, now and in the future by E&MJ's favorite analyzer, William P. Shea. p 91

Item: A Soviet machine for shaft sinking which indicates the scale on which the Russians think. p 89

There's more: See the contents page, please.

Our old friend the beachcomber has just returned from his first transcontinental jet flight. We are in receipt of his notes and other memorabilia, delivered in a plain brown wrapper.

"Arrived at airline terminal on New York's East Side at 1 pm local time, still staggering under assurance by charming lady at ticket office that would be arriving in San Francisco by 3:15 (their time) same afternoon. Always troubled by time zones, found young lady's grinning assertion incomprehensible.

"Informed could check baggage right at terminal in town. Convenient. Felt red-carpet advertisements might be telling true story.

"Advertisements horribly true. Red carpet everywhere in evidence. Creeps up, finally winds around arms and throat and eventually stifles human outcry. Instance: Since baggage already checked, bus goes directly to hot, lonely tin shack far from humanity. Jet noise presumably unpopular with less-ferior non-jet passengers, so airplane parked three miles from main terminal at field. First air departure in life when failed to telephone spouse before takeoff.

"Finally directed from hot tin shack to hot jet airplane. Informed by extremely tanned, healthy, uniformed young girl that new jet was air conditioned, would be just lovely once engines started.

"Sat in hot airplane on hot tarmac for 45 minutes waiting for Government official to arrive by helicopter. Spent time in constructive thoughts of how to overthrow present government. As official arrived with six grey-flanneled male handmaidens, had just reached plan to manufacture invisible carbon paper ink, eliminating all copies of memos and wiping out two-thirds of handmaidens.

"Extremely young, healthy, tanned, uniformed young lady passed, still smiling. Walked through curtain behind seat. Asked her, on return, what was behind curtain. 'More passengers, tourist class.' Realized importance of own status. Felt subdued.

"Engines turned on. Strangely quiet. Combination of awe at being in seat in front of plane combined with eerie engine quiet compounded by non-corporeal voice suddenly announcing above head 'thisisyourcaptainspeaking'.

"Voice full of confidence. Announced 'those passengers who had never flown jets before might notice some difference.' No condescension; sincere interest and sympathy. Passengers might note that takeoff speed did not seem adequate to get plane off ground. Also lack of feeling of sufficient acceleration. Fought desire to leave plane.

"Distracted by young, tanned, healthy girl. Girl reaching up over front seat, holding strange hygienic contraption in left hand. Contraption made of tubing and plastic ether cone. Second disembodied voice, this time young, tanned and female, began describing what to do should emergency oxygen supply be needed. Need not anticipated, but young, tanned, etc., thought should inform anyhow. Desire to leave plane almost uncontrollable.

"Realized that young, tanned, etc., was not one girl but three. Matched set, blonde, possibly left over from cosmetic commercial.

"Takeoff begun. Acceleration unnoticeable. Speed patently inadequate. Quietly totted up insurance policies, regretted inability to call spouse.

"Plane presently airborne, all going swimmingly. Thisisyourcaptainspeaking on again. Touch of condescension this time. Would be at 29,000 ft. Weather in San Francisco good, no difficulty expected in between. Would be keeping in touch during flight.

"Young, tanned, etc., offered drink. Felt compulsion to challenge red carpet. Beer? 'Of course.' Felt a fool. Should have known. Beer cold, canned, domestic. Felt less a fool. Red carpet should provide imported. Offered second beer. Accepted. Asked about people behind curtain. Drinks for them? Told no. Felt fetally protected. *Belonged* for first time since class picture, 1909. Meal adequate, reheated. Less said the better.

"Slept long and easily. Motors really quiet. Awoke to thisisyouretc. informing that crossing of Rockies would take 15 minutes. Gave thought to Donner party.

"Landing on Lower Peninsula smooth and easy. Felt admiration for thisisyouretc. Good man. Bus ride to San Francisco exhilarating solely because San Francisco at end of ride. Greatest city in world. Called distraught spouse, tried to explain hot, little, tin, telephone-less shack. Spouse's remark: "Who was she?' Sometimes feel wife doesn't understand.

"Interesting sidelight. On Coast for three weeks, veering up and down landscape, confirming and reserving flights. Each and every member of airlines personnel, regardless of affiliation, noticed ticket and asked opinion of jet flight. Time not permitting extensive summary, said 'interesting'. Seemed to satisfy most interrogators.

"Return flight much like first. Matched blondes replaced by matched brunettes. Beer still canned and domestic. Departure on time, but arrived in Philadelphia instead of New York. Weather. Two-hour bus ride from City of Brotherly Etc. Arrived too late for commuters' transportation. Checked into hotel. Good night's sleep; clerk did not enquire how liked jet flight. Restful.

"Enclosures: Unopenable cigarette packages with non-favorite brand.

"Take the jet. Get there in half the time. Ha."

EVERYTHING'S BIG ABOUT THE D9

. . . *including economy!*

You don't sacrifice economy for big production when you step up to a Cat D9 Tractor. When you see big loads of pay dirt rolling in front of a D9—those can be the most economical yards in strip mining today!

Arrington Mining Co. has found this out at its open pit iron ore mine at Troy, Alabama. Its D9 with No. 9S Bulldozer economically strips overburden that is up to 25 feet thick.

Besides, partner Tom Arrington says, "The D9 is worth what you pay for it in dependable service—and I find Cat machines have a high resale value."

Many features contribute to the outstanding economy and resale value of the big D9. To name a few: dependable Cat Diesel Engine with new dry-type air cleaners, the exclusive Caterpillar oil clutch, strong main frame and final drives, long-lived, extra-rugged undercarriage, including lifetime lubricated rollers and idlers.

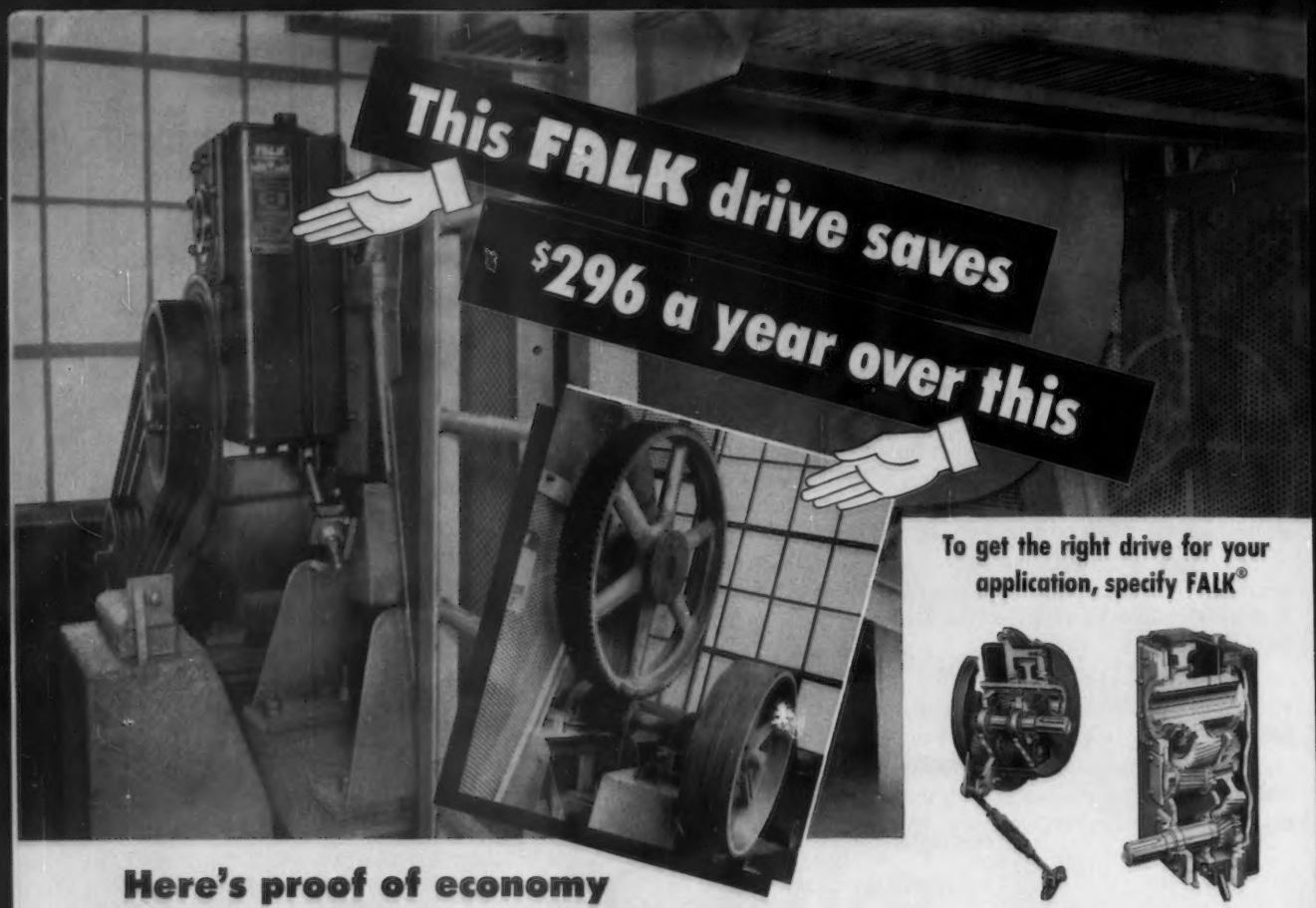
Get all the facts on the mighty D9—and a demonstration on your strip mining operation—from your Caterpillar Dealer.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

THE D9...
BIG IN PRODUCTION,
BIG IN ECONOMY



Here's proof of economy with FALK Shaft Mounted Drives

PROBLEM—For many years, a prominent Eastern abrasives manufacturer* experienced high maintenance and down-time costs, as well as excessive noise and vibration, in the operation of 19 pebble mills driven by open spur gears. Drive gears and jack shaft pillow blocks required frequent repairs or replacement, and trunnion shafts often failed, due to radial overloading of the bull gear when broken pinion teeth bottomed between gear teeth.

SOLUTION—After numerous unsuccessful approaches to these problems, the solution was found by mounting a Size 315J FALK Shaft Mounted Drive directly on the mill drive trunnion. This eliminated objectionable gear noise and vibration...greatly reduced costly down-time and loss of production...and cut annual maintenance and replacement expenses as indicated by the following figures taken from the customer's records:

Spur Gear-and-Pinion Drive		FALK Shaft Mounted Drive	
Bull Gears	$ 56	VEE Belts	$ 30
Pinions	120	FALK Shaft Mounted Drive (based on 10-year life)	70
Pillow Blocks	90		
VEE Belts	30		
Trunnion (5-year life)	100		
Annual cost	$396	Annual cost	$100
		ANNUAL SAVINGS	$296

IF OBSOLETE DRIVES ARE COSTING YOU MONEY, a change to Falk All-Steel Shaft Mounted Drives can effect important savings in money and production. Used on almost any type of machine, these compact, rugged units are establishing new standards of economy and efficiency in many industries. Specify FALK Drives on your purchased equipment...For full details, **write for Bulletin 7100.** *Name on request

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

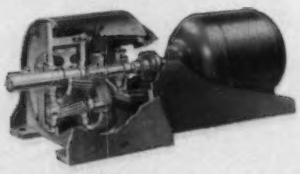
Representatives and Distributors in Most Principal Cities

To get the right drive for your application, specify FALK®

SHAFT MOUNTED DRIVES

Horizontal or vertical units—½ to 50 hp—420 to 5 rpm—single and two double reduction ratios—output torque ratings up to 41,000 lb-in (consult factory for higher torque capacity).

• • •



ALL-MOTOR® MOTOREDUCERS

Sizes up to 75 hp—furnished with or without standard foot-mounted motor—standard output speeds 1.2 to 520 rpm (with 1750 rpm motors) —ratios as high as 54,000:1 in semi-standard designs. Integral units (gearmotor type) also available. Ask for **Bulletin 3100.**

• • •

FALK Drives are available from factory and distributor stocks from coast to coast. Consult your Falk Representative or Distributor.

FALK

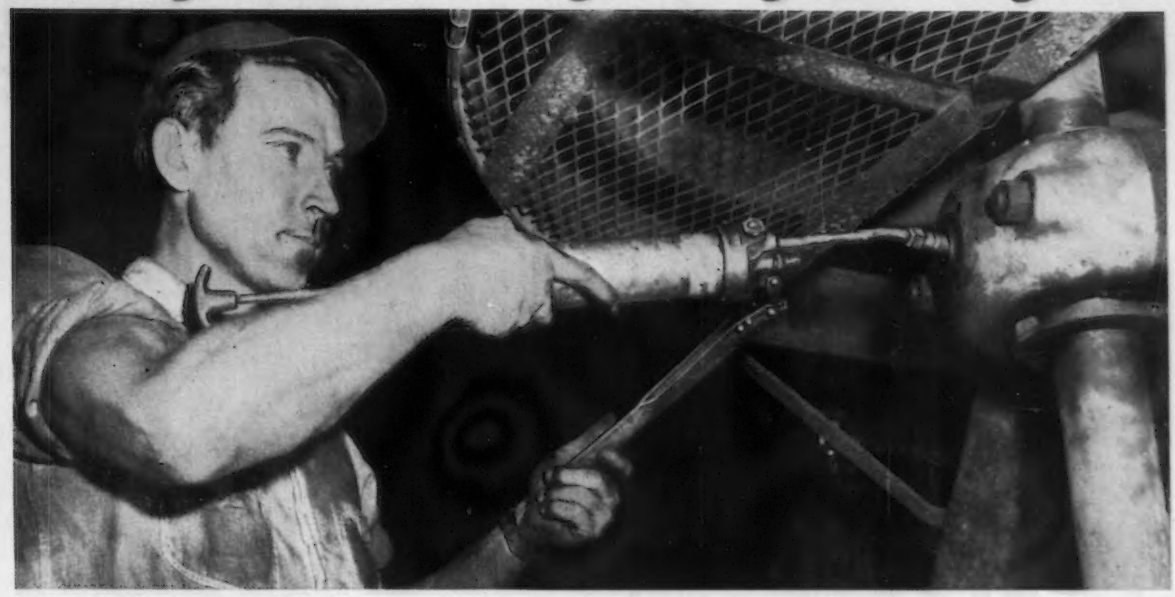
...a good name in industry

ENGINEER'S FIELD REPORT

PRODUCT **CHEVRON INDUSTRIAL GREASE**

FIRM **CALERA MINING CO.** Cobalt, Idaho

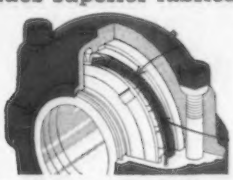
Bearings last 800% longer using Chevron grease



Escaping 240° steam caused bearing failures in only 2 months on this ore conditioner at Calera Mining Co. until firm changed to Chevron Industrial Grease. Now, identical bearings lubricated with this moisture—high temperature-resistant grease last 18 months, 800% longer...need lubrication just once each 24 hours instead of 3 times every 8-hour shift. Bearings are pillow blocks for 17½' impeller shaft which churns ground cobalt ore with steam, air and lime to aerate it prior to differential flotation.

Mill Foreman J. O. Vecchies (right) and V. Fliflet, Standard Oil Representative, stand on 15' diameter ore conditioner to examine bearings and impeller drive. Replacing these 3-3/16" taper roller bearings is a 4-hour, 2-man job, and shuts down entire mill. Increased bearing life with Chevron Industrial Grease saves the equivalent of 64 hours labor, with a corresponding increase in productive capacity. Mill is only source of cobalt in Western Hemisphere. Firm has used Chevron Industrial Grease since 1955.

Why Chevron Industrial Grease provides superior lubrication



- Top wear-prevention qualities
- Pumpable over wide temperature range
- Mixes with any grease
- Extreme work stability
- Melting point, 500°F. plus
- Rust protection
- Non-corrosive
- Unusual water resistance

For More Information on Chevron Industrial Grease or any other petroleum product, or the name of your nearest distributor, write or call any of the companies listed below.

CHEVRON Industrial Lubricants

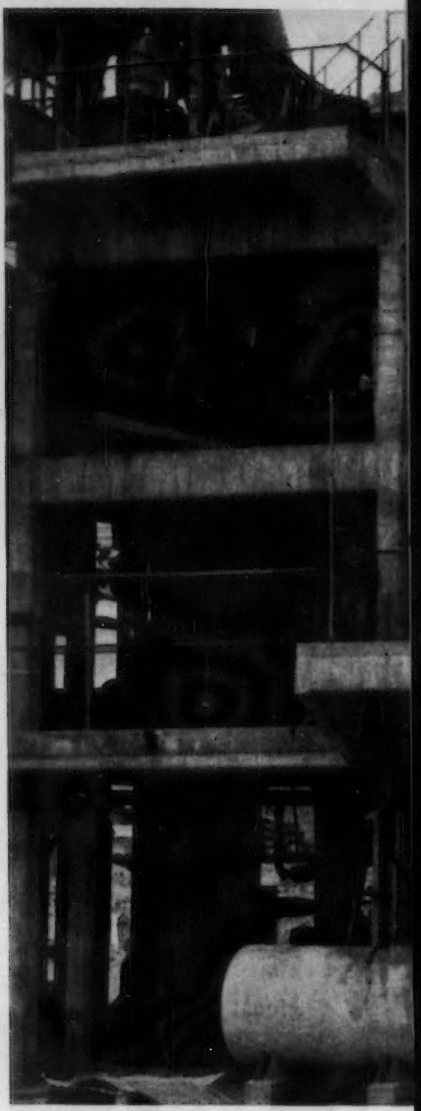
TRADEMARKS "CHEVRON" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

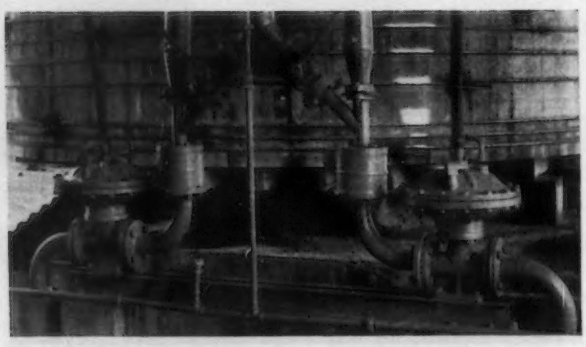
STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

At right . . . installation of the Dorrco FluoSolids Reactor at the Atlas Fertilizer Corporation's plant, Toledo, Cebu, Philippine Islands.

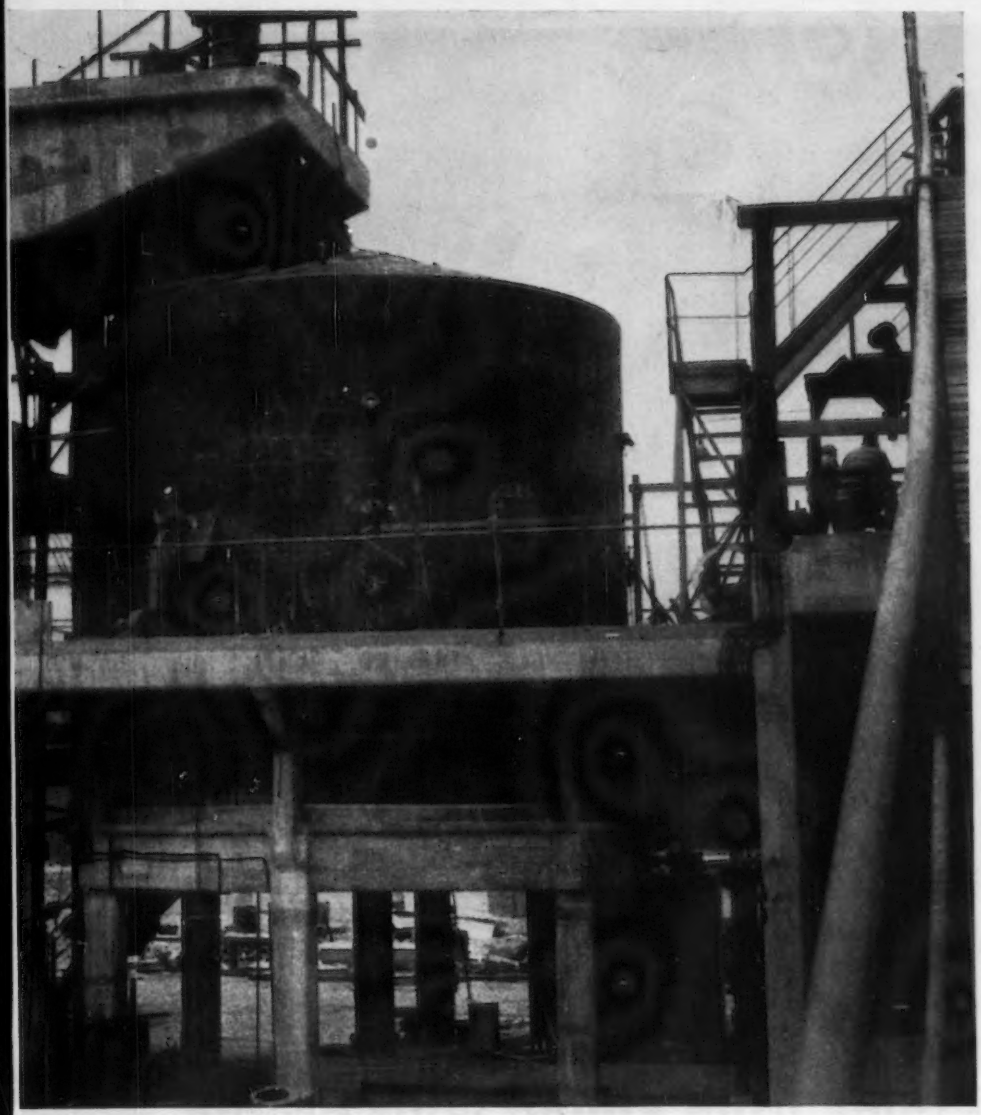


DORRCO FLUOSOLIDS SYSTEM

pays off in pyrites roasting



Two ODS diaphragm slurry pumps handle feed slurry from storage agitator tank. Dorr-Oliver design provides for operation of diaphragm with compressed air, eliminating mechanical linkage. Installation shown here provides for alternative operation of either pump, the other functioning as a permanently connected spare.



operation for Philippines fertilizer plant

The world-wide recognition of the advantages of the Dorrco FluoSolids system for pyrites roasting is demonstrated in another installation now in operation for the Atlas Fertilizer Corporation on Cebu Island, Philippines Archipelago. This installation is also a further example of the global character of Dorr-Oliver service, since equipment and engineering were handled by D-O's associate company in Paris, France.

The heart of the system, an 18′ I.D. FluoSolids Reactor is designed to roast up to 105 metric tons per day of 43% sulphur pyrites concentrates, producing strong SO_2 gas for acid manufacture. An associated contact acid plant produces 120 metric tons of 100% sulfuric acid daily.

The Dorrco FluoSolids system is applicable to a wide range of roasting, calcination and drying operations in the metallurgical and chemical industries. For information on its possible use in your particular operation, write to Dorr-Oliver Incorporated, Stamford, Connecticut. If your interests include overseas plants, you may also find it worth while to consider the many possible savings and other benefits to be secured through the facilities offered by Dorr-Oliver's international organization.

Dorrco and FluoSolids—Reg. T.M. U.S. Pat Off.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

TEXACO ORGANIZED LUBRICATION CAN HELP YOU...

Keep his guns from killing your profits

His grease guns are aimed at your profits; they can help boost them — or eliminate them altogether. Here's why:

You used to need a different grease for nearly every job. That meant 20 or 30 lubricants at the mine, with the almost inevitable danger of misapplication — and damaged machinery. *Now, with the rapidly increasing mechanization of mine operations, this can be a ruinously expensive policy.*

Yet, unless you are operating on the basis of a modern lubrication survey, *the chances are that this situation still exists at your mine!*

A Texaco Organized Lubrication Plan uses a minimum number of proper oils and greases — including newly developed multi-purpose lubricants — to reduce your inventory by as much as 80% and virtually eliminate this problem.

Get the details on Texaco Organized Lubrication. Contact your local Texaco Lubrication Engineer soon. He can give you an approximate dollar-and-cents prediction of the money you can save by adopting the Texaco Plan. Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

Introducing

The New Earth-Mover Rim

for today's heavier loads
and tomorrow's
new equipment

Tru-Seal—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

To meet the increased tonnages and the higher speeds of today's and tomorrow's earth-moving equipment, Goodyear presents a whole new line of heavier, stronger rims.

The new Earth-Mover Rim offers these standout advantages in every size from the smallest to the largest:

Extra thickness and weight to withstand greater horsepower, greater tire pressure and heavier loads. Down time reduced to a minimum.

Heavy-duty bead seat band driver—to prevent slipping.

Sealing ring – Goodyear's famous Tru-Seal principle provides positive air seal.

The Goodyear Earth-Mover Rim is now available in 29-inch and 33-inch diameters. These fine job-fitted rims are your best insurance against premature tire and rim failure.

Next time you need rims, why not benefit by Goodyear's incomparable experience in building rims of every kind and size for all types of vehicles. See your local distributor, or write:

Goodyear, Metal Products Division, Akron 16, Ohio.

Your tires go farther on RIMS by

GOODYEAR

MORE TONS ARE CARRIED ON GOODYEAR RIMS THAN ON ANY OTHER KIND

If any of your work is in sandy soil, you well know all the maintenance tracks need. This New Jersey company figured they spent $22,000 in parts alone every year. So they switched to rubber, now

SAVE BIG REPAIR BILLS, GET MORE WORK DONE!

Bennett Sand & Gravel Company, Manasquan, New Jersey, qualify as *real experts* on track wear. All their work is in gravel or high-silica sand, which forms the floor of their 1,000 acre quarry. In the past, they figured re-bushing and new sprockets were needed on each of their crawler-dozers twice a year. Complete sets of rails had to be replaced every eight months. Rebuilding jobs on three crawler dozers cost over $22,000 per year *in parts alone.* Shop time for the track repairs totalled *400 to 500 man-hours per year.* To eliminate this high cost, Bennett decided to try rubber. Their local Michigan Distributor heard about it, got permission to demonstrate a Model 180 Tractor Dozer. Bennett management liked it so well, they insisted it stay right on the job.

"Tires don't wear out"

The Michigan started to work in summer, 1956. To date, the tires show virtually no wear. Paul Bennett, Jr., Company Vice President, says he expects them to "last indefinitely." For comparison, he points to a tractor loader which has worked constantly and still has original tires after 6 years. A bottom-dump hauler has original treads after 9 years. So, Bennett figures, the tires on their Michigan dozer, with its steerable wheels, should be good for thousands of hours. The machine does everything, too . . .

Spread at 6 scattered dumps

Its regular jobs include:

1. Keeping three big sand dumps pushed off. Types of sand: mason, concrete and coarse grade. Job was once tried by another make of rubber-tire dozer, but it bogged down hopelessly in the often-wet sand.
2. Spreading truck-dumped gravel at three dumps: pea-size, ⅜" and 1" stone. Major advantage in this operation is way Michigan's low-pressure tires don't crush the gravel . . . a real problem with crawlers when selling gravel for state work.
3. Cleaning spillage from haul roads.
4. Cleaning around washer.
5. Building roads at secondary pit five miles away. Unit gets to this assignment *under its own power* at 27 mph.

"Easier to run than crawlers"

"We do about 50 kinds of odd jobs, as well," says John Gifford, a dozer operator with Bennett *since 1940.* "The Michigan is a pleasure to run all the time. Hit a good-sized stone while driving a crawler, for instance, and you really get a jar. In our Michigan, you roll right over it, stay in perfect control. It's a cinch to operate the Michigan after running a crawler—and a lot faster too. *Michigan gets around the plant as fast as a truck,* handling dozens of jobs—doing well at all of them!"

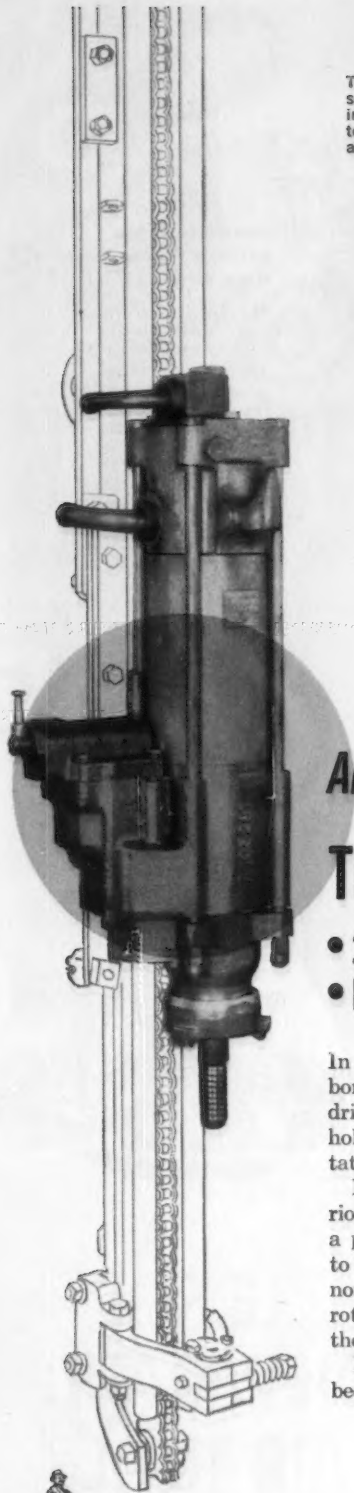
Available on lease-purchase

If slow speeds and sand-in-the-tracks are grinding away at your profits, it will pay you to get full facts on this Dozer. Your local Michigan Distributor will be glad to arrange a trial demonstration—*you* pick the job. You *needn't* keep the Michigan we demonstrate . . . but we guarantee if you have any work in sandy soil, or any scattered odd jobs, you'll be tempted. All sorts of purchase plans can be arranged . . . including no-money-down, pay-as-you-profit lease-purchase.

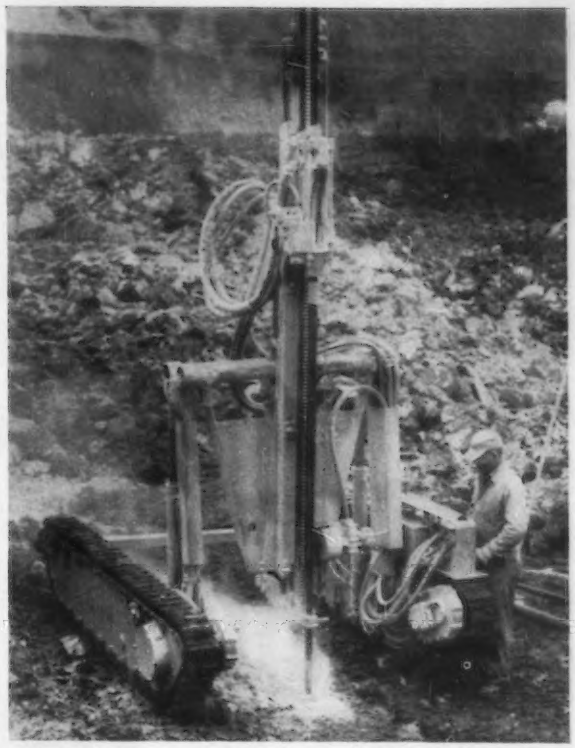
Michigan is a registered trade-mark of

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2465 Pipestone Road
Benton Harbor 36, Michigan
In Canada: Canadian Clark, Ltd.
St. Thomas, Ontario

CLARK® EQUIPMENT



The 450-DR is available on several self-propelled carriers, including the completely automatic TDM Trac-Drill shown at the right.



Another Joy First

The 450 DUAL Rotation Drill

- 25% Higher Drilling Speeds
- Faster Steel Changes

In competitive demonstrations of 4½" bore drills, the new Joy 450-DR not only drilled faster, but also finished blastholes which the conventional reverse rotation machines could not bottom.*

Dual Rotation, which made this superior performance possible, is provided by a powerful vane-type air motor geared to the chuck. It provides a booster to normal drilling rotation, and gives extra rotation power while actually reducing the strain on the rifle bar.

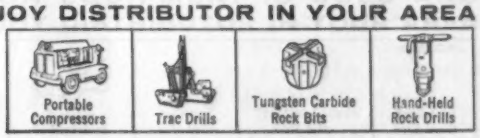
Dual Rotation will also cut your costs because (1) there is no hammering action while coupling or uncoupling—drill steel threads, couplings and striking bars last longer; (2) all four pawls in the 450-DR are used only for forward rotation, not two for drilling and two for reversing—excessive pawl wear is eliminated; and (3) with Dual Rotation, reversing is not rifle bar actuated, therefore rifle nuts cannot back off—less downtime.

Let us prove the superiority of the new Joy 450-DR Drill. Your nearest Joy Office or Distributor will be glad to arrange a demonstration of this remarkable new drill.

*Competitive test results available upon request.

C 7577-316

JOY CONSTRUCTION EQUIPMENT IS SOLD AND SERVICED BY THE JOY DISTRIBUTOR IN YOUR AREA



JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

YOU'LL NEVER BURN OUT AN AIR TOOL

with the new Le Roi LO-380 line oiler...

EMPTY OILER SHUTS OFF AIR!

Here's how the LO-380 Saves Tools—Cuts Repairs!

(1) Inlet reed valve meters air into the oil-resistant bellows

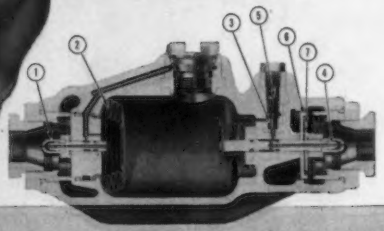
(2) which creates pressure that forces regulated amount of oil through porting connected to the needle valve (3) and the porting connecting it to the outlet reed valve

(4) through which oil is injected into the air stream.

(5) Set screw permits easy external adjustment of oil feed during operation.

(6) Positive pressure differential valve assures correct oil feed for all air flows — eliminates oil waste.

(7) Shut-off valve automatically stops air when oiler is empty. As oil supply goes down, bellows (2) expand and contact the shut-off plunger, depressing it until the valve reaches the automatic shut-off position.



That's right! *You'll never burn out an air tool with the new Le Roi LO-380 on the job!* When the oiler runs dry, it automatically shuts off the air! The "no oil — no air" design prevents unnecessary wear on critical parts — cuts repair bills — extends tool life!

The new line oiler assures positive lubrication for air tools — delivers a steady mist of oil at 10 to 150 psi — and keeps it flowing until you shut the air off, or until the empty oiler shuts it off automatically. Metered oil flow provides exceptional economy, prevents oil splurges. As a matter of fact, the LO-380 will pay for itself in a short time through oil savings alone!

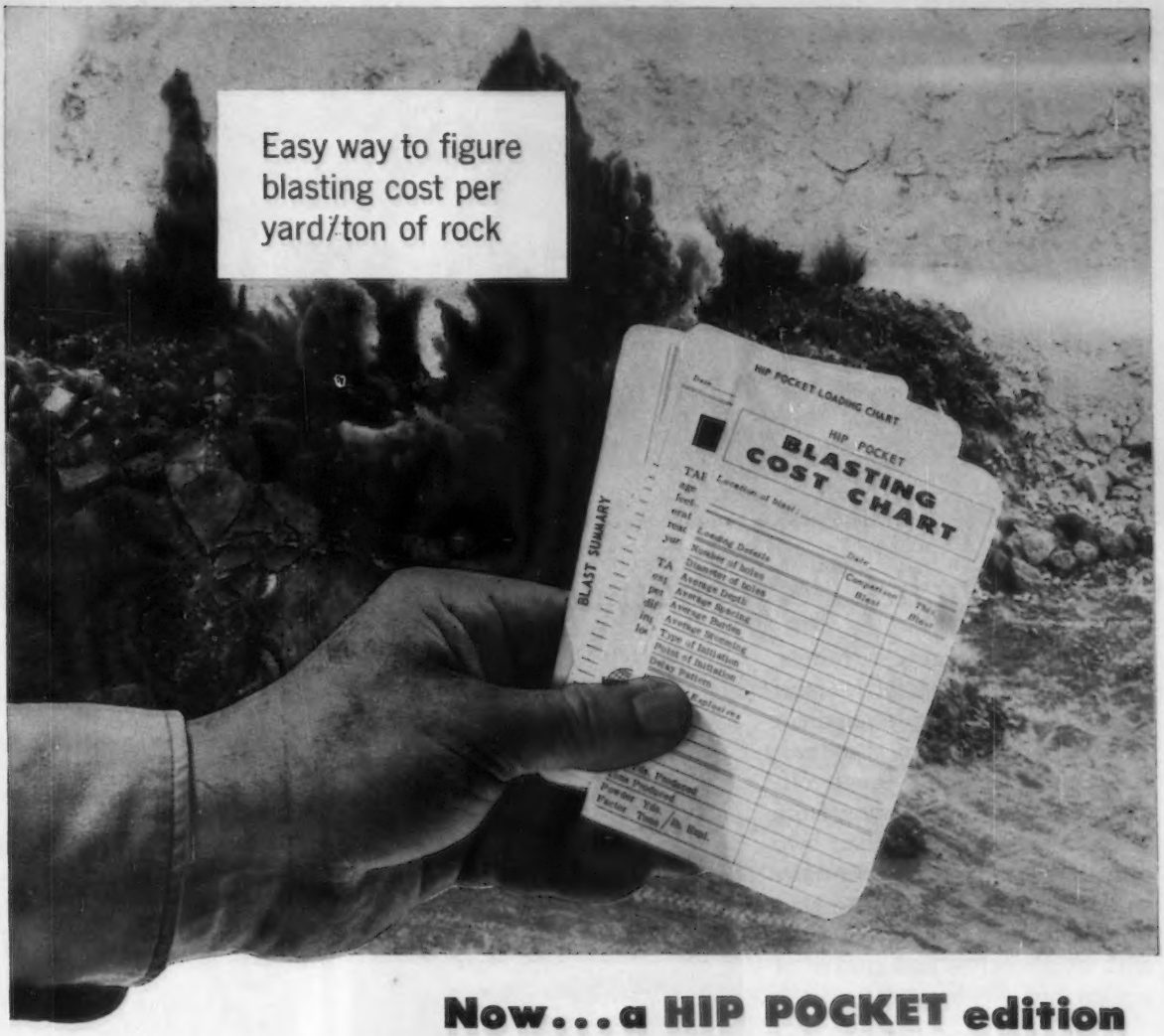
Oiler permits easy external adjustment of oil feed — provides full one-pint capacity. Lightweight — only 9 lbs. — it's easy to use, easy to move—operates in any position. Oiler can be refilled under pressure while air tool is in operation.

Contact your nearest Le Roi distributor for details — or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-906


Easy way to figure blasting cost per yard/ton of rock
HIP POCKET LOADING CHART
HIP POCKET
BLASTING COST CHART
BLAST SUMMARY

Now...a HIP POCKET edition of the Atlas BLASTING COST CHART

Here's a new 1959 Atlas Blasting Cost Chart that goes right out on the job with you—helps you record the cost data you need to protect your profits.

The original Blasting Cost Chart, with instruction book and Slide Rule, is being used successfully by hundreds of operators. Now, to make it more convenient, Atlas has added this "hip-pocket" edition. With it you can compare results from blast to blast to determine methods that pay off best. It helps you assemble quick cost facts on drilling, secondary breakage, digging, hauling, and crushing.

Your Atlas representative will be glad to show you how to use the new "hip-pocket" Cost Chart. He has a kit full of information that may help reduce your costs and protect your profits. Ask him for details, or write us direct.

EXPLOSIVES DIVISION
ATLAS
POWDER COMPANY
WILMINGTON 99, DELAWARE
Offices in principal cities

Ask your Atlas representative to show you the electric match demonstration . . . See why Atlas E. B. Caps lead the field in dependable performance.

Rear-Dump "Eucs" have payload capacities of 10 to 50 tons—are powered by engines of 132 to 670 total h.p. . . . have loaded speeds up to 41 mph.

Check Euclid Performance for Lower Hauling Costs

Leading contractors, mines, quarries and industrial users of heavy earthmoving equipment the world over have standardized on Euclids for tough off-highway hauls. They know from years of experience on their own operations that "Eucs" get more work done every shift — that production cost is lower than with other types and makes of equipment.

Euclid has a complete range of sizes and models to fit every job requirement — rear dump and bottom dump haulers, self-powered scrapers and the world's most powerful crawler tractor. Your Euclid dealer will be glad to provide a production-cost estimate on your present or planned operations — be sure to see him before you replace or add to your equipment fleet — and have him show you why Euclids are your best investment.

EUCLID Division of General Motors Corporation
Cleveland 17, Ohio

Bottom-Dumps carry payloads of 13, 17 and 25 cu. yds. struck . . . are powered by 227 to 335 h.p. engines . . . have top speeds up to 34 mph. Full length, unobstructed door openings make these "Eucs" ideal for dumping free-flowing material into drive-over hoppers.

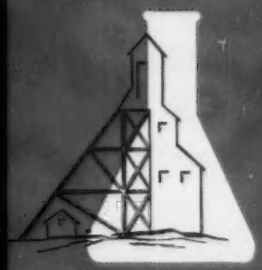
The TC-12 Crawler has 2 engines and independent track-drive . . . 425 net h.p. . . . full power shift . . . top speed of 7.8 mph. This "Euc" tractor has unequalled work-ability for heavy dozing, ripping and similar work in construction, mining and logging.

This "Twin" Scraper has 2 engines with Torqmatic Drive . . . all wheel drive permits self-loading . . . struck capacity is 24 cu. yds. There are six other Euclid Scrapers, overhung engine and six wheel types, with struck capacities ranging from 7 to 24 yds.—9 to 32 yds. heaped.

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE



CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

AEROSOL® OT

SURFACE ACTIVE AGENT

improves filtration, cuts concentrate drying and shipping costs

Effective filtration aid that lowers the water content of the filter cake, AEROSOL Surface Active Agent has produced these typical savings at metallic and non-metallic operations:

SULFIDE ZINC CONCENTRATES

AEROSOL OT-75% is fed as a 1% solution to the launder carrying concentrates to the filter at the rate of only 0.07 lb. per ton of concentrates. Moisture content of concentrates is cut by two percentage points, filter cake is easier to handle, less filter blinding occurs. Metallurgy is not affected by recycle of filtrate to flotation.

Use of 4¢ per ton of AEROSOL OT has cut concentrate freight costs 10¢ per ton!

SILICA SANDS

AEROSOL OT-75% is fed as a dilute water solution at the rate of 0.025 lb. per ton of sands going to a horizontal sand filter. Moisture content of filtered sands dropped from 6.5% to 4.5% with a resulting saving of 11.0¢ per ton in drying costs.

Thus, a penny per ton for AEROSOL OT with a resulting drop of 2 percentage points in filtrate moisture produced a net saving of 10¢ per ton on preparation costs.

AEROSOL OT Surface Active Agent is available both as a dry solid 100% grade and as a 75% aqueous solution. Phone or write our nearest office for technical data, working samples and price quotations.

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID OF CANADA LIMITED
100 Bloor Street East,
Toronto 5, Ontario, Canada

CYANAMID DE MEXICO, S.A.
Apartado Postal 255
Mexico 1, D.F., Mexico

CYANAMID OF GREAT BRITAIN LTD.
...ch House, Aldwych, London W.C. 2, England

SOUTH AFRICAN CYANAMID (PTY.) LTD.
P. O. Box 7552,
Johannesburg, Union of South Africa

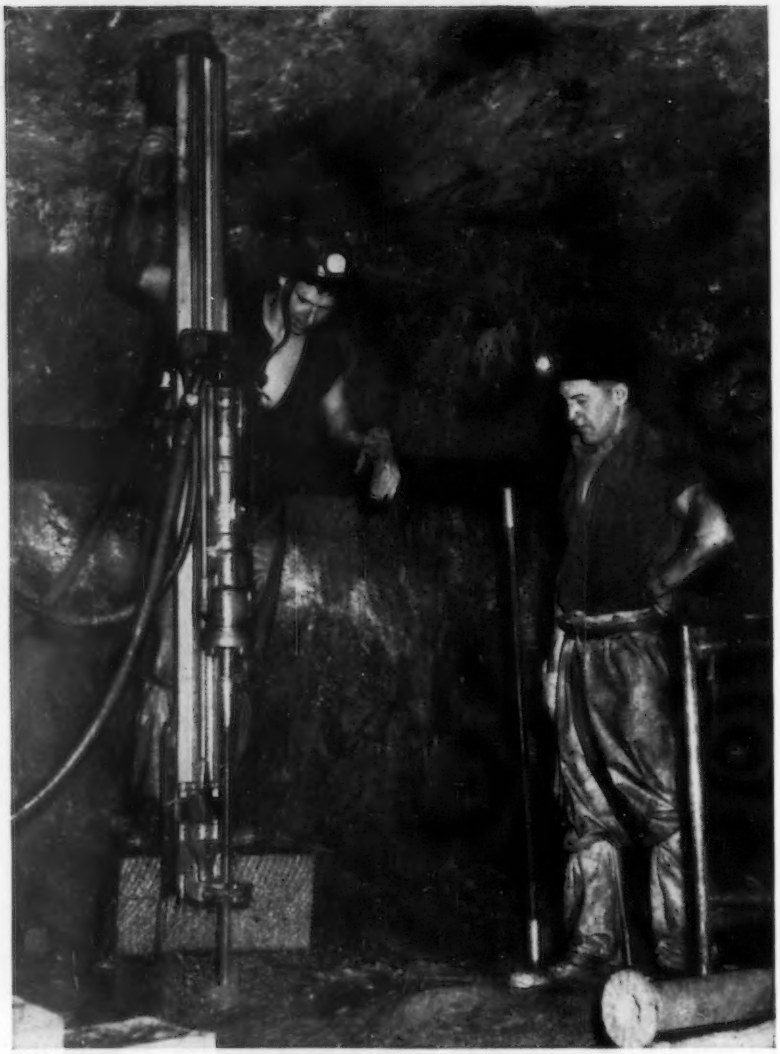
E. P. CADWELL
Camilla 1883, Belen 1043,
Of. 7, Lima, Peru

CYANAMID AUSTRALIA PTY. LTD.
"Collins Gate"
277 Little Collins Street
Melbourne, Australia

Cyanidation Process Chemicals
Flotation Reagents
Flocculating Agents
Film Forming Agents
Surface Active Agents

High Explosives
Permissibles
Seismograph Explosives
Blasting Agents
Blasting Caps
Electric Blasting Caps
Blasting Accessories

Deep Hole Drills
Drifters
Air Feed Leg Drills
Sinkers
Stopers
Broaching Drills
Chain Feeds
Screw Feeds
Hydraulic Drill Booms
Hydraulic Drill Positioners
Remote Drill Controls
Jumbo Components
Jumbo Carriages
"Air Trac"® Crawler Drills
"Mole-Drils"*
Carburized Drill Steel
Couplings
Ring Seal Shanks
Mine Car Loaders
Columns
"Airslushers"
Stationary Compressors
Rotary Portable Compressors
Grout Pumps
Slurry Pumps
Dewatering Pumps
Impact Wrenches
Air Maintenance Tools
Air Hoists
Bit Grinders
Oil Forges
Air Line Oilers
Drill Steel Sharpeners



In step with modern mining needs —GARDNER-DENVER

Why is Gardner-Denver so often first choice in mining properties throughout the world? Over the years Gardner-Denver engineers and mining men have worked side by side. Their combined know-how, experience and resources have led to the development of equipment for use in every type of rock and ore—safer, more productive equipment that meets the need of modern mining in open pit and underground.

That's why—time and again—penetration rates go up and costs per foot of hole come down when Gardner-Denver drills and drill steel are used . . . why Gardner-Denver mine car loaders, drilling equipment, pumps and compressors are favorites among mining men everywhere.

At Gardner-Denver there's no substitute for men—our 100-year philosophy of growth. See your Gardner-Denver mining specialist soon.

GARDNER-DENVER Since 1859 100 1959 YEARS

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

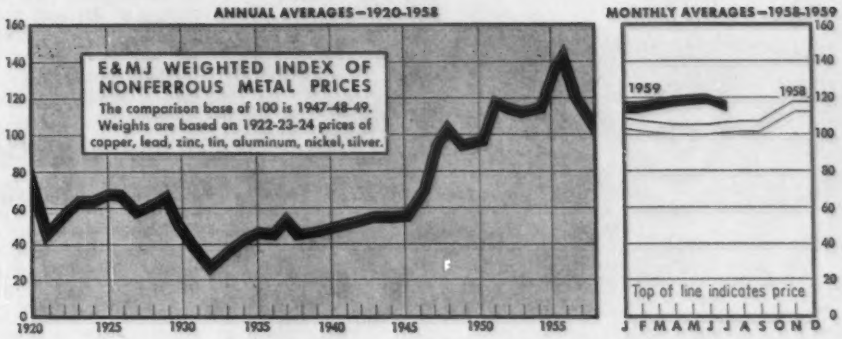
GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
Export Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

*Trade-Mark

E&MJ OUTLOOK

PRICES



MARKETS

For the first time in a year, E&MJ's metal price index took a significant dip, from 121.0 for June to 118.9 for July. Lower tin and copper prices were responsible for the drop.

●

AT HOME

The Maine Mining Bureau has granted a long-term mining lease covering about 150 acres of State-owned land in Knox County to Roland F. Beers Co. which is exploring a copper-nickel prospect. The program includes diamond drilling, electro-magnetic surveying and detailed field mapping. The Beers company has been active in several other areas in Maine.

About 50 companies are conducting research and development work on beryllium, according to Lawrence Boland, vice president of Beryllium Corp. Major objective is to reduce brittleness so that the metal can be used more widely in aircraft and spacecraft.

Molybdenum Corp. of America and American Potash & Chemical Corp. have made an agreement under which American Potash will exclusively develop the use and distribution of MCA's rare earth products in the glass industry. Source of material will be the large rare-earth deposit at Mountain Pass, Calif.

New Jersey geologists have been looking frantically for a 100-million ton iron orebody which isn't there. The Edgewood Lake deposit is not in New Jersey, as reported in this column last month, but in Alabama. Our apologies.

Vitro Idaho Minerals Corp. has been formed by Vitro Minerals Corp. and Western Fluorite Mining Co. to develop and mine uranium properties near Stanley, Idaho, and to explore and develop new mining properties in Idaho and the Pacific Northwest.

●

LABOR

Soaring imports of steel are stiffening resistance to cost increases in the domestic steel industry. Imports, which averaged about 140,000 tons per month during 1958, are now approaching the 400,000-ton-per-month rate. Some steel company executives regard cost-cutting, not tariffs, as the only realistic method to recapture markets lost through imports.

●

ABROAD

Premier Joseph Smallwood, of Newfoundland, announced that Iron Ore Co. of Canada will spend $75-million in 1960 to build an iron ore processing plant in the Carol Lake region of Labrador. The new plant will process up to 6-million tons of iron ore per year. Concentrates will run nearly 70%, according to Premier Smallwood.

Aluminum Company of America has acquired a lease on bauxite lands in the Mocho area, Clarendon Parish, Jamaica. Current plans call for prospecting extensive deposits in the mountainous area in central Jamaica.

American Smelting and Refining Co. has contracted to purchase 4,400 short tons of blister copper per month from Southern Peru Copper Corp., beginning early in 1960.

THIS MONTH IN MINING

NEW PRIMARY and secondary crushing capacity, conveyors and a 1-million ton blending pile will be included in a new expansion at Kaiser Steel Corp.'s Eagle Mountain iron mine. The blending pile will be split to permit 50-50 buildup and depletion and will provide one-month's uniform feed for the mill (center).

Kaiser Continues Eagle Mountain Expansion

IN WHAT has appeared to be an almost continuous expansion program, the Kaiser Steel Corp. property at Eagle Mountain, Calif. has continued its growth to meet the demands of the company's steel plant at Fontana, Calif. and the growing demand for steel in the West.

The latest phase, which is now under construction at Eagle Mountain,, involves new primary and secondary crushing facilities, construction of a 500,000 ton capacity blending system, and new loadout techniques.

The expansion is based on the new needs of the Fontant plant, which recently raised ingot-tons-per-year capacity from 1,493,000 to 2,933,000, and added a blast furnace, slabbing mill, hot strip mill and a second electrolytic tin plating line.

The new primary crusher, a 60-in. Nordberg gyratory, represents a threefold increase in primary capacity at the pit head. Secondard crushing has increased from two to six Symons cones, two standard and four short head.

The innovation of the blending pile is expected to make for vast improvement in the jig at the mine-site, which handles the extremely variable magnetite-hematite-silica-phosphorus-sulphur ore.

The blending systems with a total capacity of 1-million tons are divided into four 800-ft sections. One-half million tons will be blended in two sections at a time to provide a month's feed to the mill. Hewitt-Robins conveyors and a stacker conveyor lay the ore down longitudinally in consecutive strata from the crusher ore. Pickup, by a Hewitt-Robins digging wheel with rakes set to the angle of repose, will take the material in horizontal passes. Thus, the single month's feed will be uniformly sized and blended.

In front of the blend piles, ore from the pit goes first to the primary, then to a surge pile and, via reclaiming conveyors to the secondaries and tertiaries. The entire complex is set "high" to keep the product moving with gravity. The secondary crushers discharge right onto screens, with the coarse being the only product which has to be physically lifted. Screen product is conveyed directly to the stackers and the blending piles.

At the Eagle Mt. end of the pipeline, Kaiser tries to keep a month's supply of concentrate, with a similar stockpile reserve at the steel plant end.

Under present market conditions, Kaiser has been shipping 10,500 tpd to Fontana, but can ship 13,500 when Fontana is at full capacity.

Texas Firm Opens Mexican Sulphur Mine

MEXICAN OPERATIONS of the Texas International Sulphur Co., near Minitatlan in the State of Veracruz, have now gone into production at the rate of 9,000 tpm. The company, with headquarters in Houston, has extensive exploration and development concessions at the town of Texistepec on the Gulf of Mexico and has spent the last four years in development of a plant for processing sulphur.

AEC Negotiates for Salt Mine For Non-Nuclear Test

THE AEC is holding meetings with Carey Salt Co. for use of Carey's mine near Winnfield, La. where AEC wishes to detonate about 10 non-nuclear charges ranging up to five tons. Purpose of the firings is to check seismic effects resulting from the explosions.

Nuclear test detection capabilities, discussed at Geneva, might be reduced by seismic decoupling techniques by a factor of ten or more and the AEC will investigate the possibility.

Test equipment will be placed in the mine and on the surface near the mine by the U.S. Coast & Geodetic Survey, who will assist with operation and analysis. It is expected that the firings will commence late this summer.

LEADING LIGHTS of the Idaho Mining Association gathered for a symbolic pose at Sun Valley in early July as out-going president Wallace G. Woolf, Kellogg (left), congratulated new president L. J. Randall, of Wallace. Looking on are (left to right): J. C. Kieffer, Wallace, first vice president; Harry W. Marsh, Boise, second vice president; and A. J. Teske, also of Boise, secretary to the Association.

Exploration Drilling Is Theme of Fall Symposium

A TENTATIVE PROGRAM for the Symposium on Exploration Drilling, October 8-10, 1959, at University Park, Pennsylvania, has been announced by the host: Department of Mining, Pennsylvania State University. Full particulars can be obtained therefrom.

Papers have been grouped under four topics: 1. Improving Core Recovery; 2. Statistics and Operations Research; 3. Large Hole Drilling; 4. New Practices. Authors include representatives of foreign and domestic mining companies, drilling contractors, equipment manufacturers, universities and government bureaus.

Coring experience in Rhodesian and western U.S. copper and in Mesabi and Labrador iron deposits will be discussed. How to plan and limit exploration effort using statistics will be outlined. And features of the growing trend toward drilling development openings will be described. Bits, hole-surveying devices, and other aids and practices will also be covered.

This is the Ninth Annual meeting in a series of Drilling Symposiums.

Mining Calendar

1959 Convention, American Mining Congress, Denver, Colo. Sept. 14-17.

Third Industrial Nuclear Technology Conference, Chicago, Ill. Sponsored by Armour Research Foundation and Nucleonics magazine, Sept. 22-24.

International Symposium on High Temperature Technology arranged by Stanford Research Institute, Asilomar Conference Grounds, Calif. Oct. 6-9, 1959.

Ninth Annual Exploration Drilling Symposium, Pennsylvania State University, University Park, Pa. Oct. 8-10.

Eighth National Clay Conference, University of Oklahoma, Norman, Okla., Oct. 12-14.

Annual meeting, AIME, New York, Feb. 14-18, 1960.

Australasian Institute of Mining & Metallurgy, Adelaide Branch, Symposium on Hydrometallurgy, "Wet Processing of Minerals and Industrial Products," Feb. 16-19.

Fifth International Mineral Processing Congress, Westminster, London. The Secretary, Institution of Mining & Metallurgy, 44 Portland Place, London, W.1, England. April 6-9.

International Congress on Research into Ground Control and Rock Mechanics, Paris, France. May 16-20.

Wyoming Mining Association, Jackson Lake Lodge, Wyo. June 10-11.

XXI International Geological Congress, University of Copenhagen, Denmark. American Geological Institute, 2101 Constitution Avenue, N.W., Washington 25, D.C. Aug. 15-25.

(This Month continues on p 116)

As We Went to Press . . .

Australia's Weipa bauxite deposits, on Cape York, are now being estimated at more than 1-billion tons by H. L. Evans, chief geologist for Commonwealth Aluminum Corp. Announcement of the increased estimate accompanied notice that a survey of hydro-electric potential and port planning are under way.

Federal Power Commission hearings on the disputed Z Canyon and Boundary Dams in northeast Washington state will move to Spokane Aug. 17. Metaline District miners and the Northwest Mining Association are in strong opposition to the projects.

Boundary and Z Canyon, both on the Pend Oreille, would cost about $272-million, produce 1,011,000 kw and, NMWA says, threaten major mines in the area.

Prospectors in the Yukon and Northwest Territories have been given tangible aid by the Canadian government, in broadening their searches at no added cost.

In the past, a prospector who had recorded a claim, or performed assessment work on it, was entitled to one free assay coupon annually for each claim. Henceforth, prospectors will be allowed 10 coupons each year prior to recording all assessment work on a claim. Cost will be split by the government and the prospector.

A 60-million-ton iron ore deposit near Dillon, Mont., has been sold by Minerals Engineering Co. to North American Utilities Corp. of Canada for cash and royalties.

North American said it plans to construct a steel plant in southern Alberta and will use the ore to feed the mill. Blair Burwell, board chairman of Minerals Engineering, noted that the 60-million tons represent blocking out of about 20% of the property.

Copper activity in the Safford area of eastern Arizona is increasing. American Metals Climax Corp. has signed options to buy 254 mining claims for a reported $3-million, and Kennecott Copper Corp. is paying some $3.8-million for 125 claims nearby. Another report said that Phelps Dodge had uncovered a vein of silver reportedly 7-in. wide while checking copper deposits in the area.

A German geological mission in Bolivia will survey for heavy minerals and oil in one area and for silver and copper in three other sections, according to reports from La Paz. Completion of the first phase is set for the end of the year.

Low-grade zinc ore will be again mined at Anaconda's Elm Orlu-Black Rock Project at Butte, with full production expected in about 10 months. According to Edward I. Renouard, vice president in charge of western operations, block caving will be employed, with hoisting through the Badger shaft. The Elm Orlu-Black Rock and the Badger were shut down in 1956.

And in this issue . . . Hanna's Groveland Mine starts shipping jasper ore, p 116; Nevada's Iron King goes underground, p 118; U.S. scientists take a thoughtful look at "The Undiscovered Earth," p 134; Franz Pick offers his views of the world of gold and currency traffic, p 144.

WASHINGTON IMPACT

Highlights

TWO PATHS TO STATUS QUO—In the aftermath of the House Interior Committee hearings on the state of health of domestic metal-mineral mining, Administration officials have made it clear they do not plan any new protection or support programs for the mining industries.

But Interior Secretary Fred A. Seaton and newly appointed Commerce Secretary Frederick H. Mueller provided mining-state Congressmen with a Dale Carnegie object lesson in how—and how not—to say the same thing politically.

The House Interior Committee approved a resolution introduced by chairman Wayne Aspinall (D-Colo.), calling on the Administration to "review at once" all its domestic mining problems with a view toward correcting their failure to meet the problems faced by "critically depressed mining and minerals industries." The resolution was then sent to Government agencies for comment.

Secretary Seaton's reply, in effect, indicated Interior Department constantly reviews its own programs, but welcomed the committee's comments and agreed with the legislators that domestic mining is a vital segment of U.S. industry which deserves all the attention and support Government can give it.

Secretary-designate Mueller's answer on the other hand—signed when he was still Undersecretary—contained what some mining-state legislators are calling "gruff and insulting" language. The point of Mueller's reply was that Commerce Department strongly opposes any additional programs directed at aiding domestic mining, and takes the position present policies and programs are adequate.

Mueller's letter so infuriated mining-state Senators that the Senate Interior Committee, which under chairman James Murray (D-Mont.) has held several hearings similar to Aspinall's in years past, immediately laid plans to call Mueller to a special hearing to explain his attitude.

As this issue of E&MJ went to press, Murray's committee was scheduling hearings to take testimony from various Government departments on their position on stepped-up Government metal-mineral support programs, on the grounds that Aspinall had heard industry and state and local officials, but no Federal policymakers in person.

No significant change in present programs or new Administration steps are likely to result without specific legislation, and most pending bills for various metals and minerals are regarded as standing little chance of passage this year. This is a judgment held by most observers on Capitol Hill and within the Administration, as well as by many industry representatives.

Actually, both Seaton and Mueller were reflecting that judgment. But they proved the old cliche: "It's not what you say, but how you say it."

TRADE POLICY UNDER MUELLER—Despite the wrong foot new Commerce Secretary Frederick H. Mueller got off on with mining-state Senators (see above), he will try to direct U.S. foreign trade policy along conservative lines that include provision for additional import protection for specific domestic industries.

In fact, his views on trade are so similar to those of his Senate-rejected predecessor, Lewis L. Strauss, say freer-trade minded Commerce Department sources, that Mueller may well sharpen the split within the agency over case-by-case application of protection provisions in the laws and regulations.

Mueller has not gone on record in the case of any of the several domestically-minded metals and minerals whose producers are seeking additional trade protection. But he fought for new curbs on imports of oil—which were approved by the White House, and favored new restrictions on imported textiles and heavy electrical equipment—which the White House through OCDM has so far rejected.

On the question of East-West trade, and administering the export controls on shipments to the Iron Curtain Bloc, Mueller is said to be as strongly opposed as was Strauss, who made it a personal campaign to curtail East-West trade.

For example, Mueller is almost certain to keep copper on the restricted list—where Strauss returned it after his predecessor, Sinclair Weeks, had previously removed it.

Further Government Aid Not Likely at Present

House Interior Committee hearings on the over-all state of health of domestic metal-mineral mining resulted in unanimous committee approval of a resolution introduced by chairman Wayne Aspinall (D-Colo.) calling on the Administration to "review at once" its domestic mining policies and programs.

Aspinall's resolution charges that Government metal-mineral programs have not been effective in meeting the problem of "critically depressed mining and minerals industries".

The resolution went to the executive agencies for comment, and the replies indicate that except for possible Congressional action to support one or more of a few specific commodities, the question of any significant new Government aid has been again closed with a definite "no". (See left.)

Against the background of the Aspinall hearings and other industry attempts to focus Government attention on its problems and win specific Federal aid, here is a rundown of some key metal-mineral cases, and the outlook for action:

Lead and Zinc—The lead-zinc problem likely will wind up back in the lap of the Tariff Commission. Mining-state Senators abandoned their move to tack new import taxes on those metals as part of the omnibus excise tax bill which was extended late in June. They dropped the long-shot tactic after Interior Secretary Fred A. Seaton hinted strongly that the Administration might tighten existing lead-zinc import quotas, expand them to cover fabricated and semi-finished products, or both.

Interior Assistant Secretary Elmer Bennett was reported to have kicked off a new Interior Department and White House "review" of the quotas with an eye toward tightening them.

Now, however, it appears that the White House has decided not to change the quotas—at least for the present. In a recent radio interview, Commerce Assistant Secretary For International Affairs Henry Kearns predicted flatly that there will be no additional trade restriction imposed by the U.S. on any imports "in the immediately foreseeable future."

So, mining-state Senators are this month working on a previous plan to force another Tariff Commission study of the lead-zinc question. Meanwhile, international production or export controls are no nearer adoption by the United Nations' continuing lead-zinc study group.

Manganese—Congressional efforts to talk the Administration out of ending its so-called "carlot" incentive purchase program for domestic manganese may result in a "compromise" of some benefit to domestic producers.

The big question is whether the move will take new authorizing legislation, in addition to new budget appropriations.

General Services Administration notified sellers its 28-million short ton unit goal for the program would be filled by Aug. 5. Producers immediately protested to their Congressmen that (1) the goal would not be filled by then, and (2) in any case it should be extended to prevent domestic industry from—in the words of Sen. James Murray (D-Mont.)—"following other domestic minerals industries down the drain".

Murray is trying to get the Senate Appropriations Committee to provide more money—approximately $23-million—for the purpose. He is aiming at purchase of at least another 10-million short ton units. But the Murray move may also need statutory authority to permit GSA to continue buying. Whether or not new authority is needed, the House is unlikely to vote much, if any, additional money. OCDM may try to strike a compromise out of existing funds and authority.

Cobalt, Fluorspar, Tungsten—Producers of these three metals are virtually certain to be forced into looking elsewhere than OCDM for new aid. Petitions for import curbs on grounds of the essentiality of the minerals to the national security were still pending at OCDM as this issue of E&MJ went to press, but even mining-state legislators were so certain the agency would turn down the appeals that they were talking about possible new legislative help for producers.

A fluorspar producers' bill to set up import quotas patterned after the domestic Sugar Act had not been acted on by the Senate Finance Committee at press time, and chances are slimmer than ever for passage this year.

Late Developments

AGRICULTURE DEPARTMENT is in another hassle with the House Agriculture Committee over extension of Public Law No. 480—the U.S. surplus crop disposal law which contains authority to barter crops for foreign strategic minerals. Some House committeemen, metal processors, and producers, favor the committee's proposal to expand barter to $350-million per year, and extend the law for three years. The Administration, grain brokers, and some farm groups are reluctant to endorse barter at all, are willing to go along only with the straight one-year $150-million extension requested by the White House.

FOREIGN TRADE and investment are continuing to hold the Congressional spotlight as a major battlefield for domestic mining policy. Western Senators late last month endorsed the Western Governors' Conference recommendations that tariffs and import quotas are the only real solution to domestic mining's dilemma.

Labor This Month

LIVING COSTS—THE BARGAINING ICEBERG: The hidden elements are more important than surface issues in labor's bargaining campaign to win, or renew, escalator contract clauses. In this summer's steel negotiations, the steel industry sought to delete the consumer's price index as a contract factor. In nonferrous metals, the Mine-Mill and Smelter Workers wanted this system—a one cent rise for every one point increase—added to their agreements. While the escalator payoffs haven't been lucrative since mid-1958, the unions are taking a long-range view in their demands. Here's the background:

The cost-of-living has held virtually steady in the past 12 months, rising only 0.3%. Government economists predict this won't change through 1959. It means that over an 18 month period, union members have collected almost nothing in escalator raises. But the system still has big appeal to unions, the reverse to management. The outlook for 1960 is a steadily rising chart line. Some predictions put it as much as 3% by the end of 1960. Ewan Clague, Commissioner of Labor Statistics, foresees a rise when the current production boom reaches a peak. Explaining the current even levels, he notes that "prices tend to remain stable until recovery has passed into prosperity." Then, he says, watch out.

WAGES CLIMB WITH RECOVERY: The disputes in metal mining and steel that extended negotiations beyond contract deadline were the exception in the first half of 1959. Federal wage figures show settlements came much easier in other industries. In fact, the most common pay hike negotiated was 13c—a good size any time. Too, fringes were increased in three out of five settlements—mostly improvements in pensions and vacations. Health and welfare plans took third place. The trend to long-term contracts continued. Two-year agreements were most common in the six month bargaining period.

NEW TESTS FOR "RIGHT-TO-WORK": Labor and employer groups are getting set for another political round over "Right-to-Work" laws. There are 19 state laws now banning the union shop; employers will attempt to add Colorado, Idaho and Montana. Union leaders are concentrating on repeal in Kansas, Utah and Indiana. Most of the contests, by referendum or through the state legislatures, will fall in 1960 and 1961. But, already extensive strategy is being worked out at the AFL-CIO's committee on political education and management's "National Right-to-Work Committee."

The struggle will be in the courts, too. A recent decision by the Appellate Court of Indiana almost assures this. The State body ruled that the Indiana "Right-to-Work" law does not bar the so-called "agency shop". This contract system does not require union membership, but it does require non-union employes to pay the equivalent of dues, fees and assessments to the union. Many other state laws have no apparent ban on the practice. If court tests uphold the method, it may become a union bargaining demand in all "Right-to-Work" states.

THE DECLINING FACTORY WORKER: Automation is cutting into factory jobs to such an extent the total may never reach pre-recession levels. The current 16-million plant jobs is almost 1-million under 1957. "Improved technology", says a Federal report, has made many jobs "nonexistent". The evidence is showing up in comparison of industrial production with employment. The report goes on: "The unequal recovery rate, which first became apparent in mid-1958, continued to be impressive because the discrepancy between man-hours and production is growing larger".

TWILIGHT OF THE McCLELLAN COMMITTEE: What are anticipated as the final sessions of the McClellan anti-rackets committee were devoted to Teamster president James R. Hoffa. Cases involving Teamster ex-convicts handled by the eight-man group over the past two years were revived. The aim: to show that Hoffa has not moved against Teamster corruption. Committee chairman John L. McClellan plans to fold up shop this summer with a final committee report on union racketeering. He says the record has been made. The rest is up to Congress.

MARKETS

Copper Prices Fall; Aluminum Strikes Off; Lead and Zinc Sales Ease

THE E&MJ INDEX of non-ferrous metal prices showed the weighted average price down to 118.9% of the 1947-'49 average in July from 121.0% in June. The drop in copper from 31.102c in June to 30.077c in July was mainly responsible.

The Phelps Dodge copper refinery on Long Island in New York State was struck by the United Steelworkers at midnight July 31, the date when the labor-management contract ended. The union has had a policy of "no contract, no work." It had demanded that any agreement reached be retroactive to August 1. A company spokesman told E&MJ it was not prepared to grant this. A union official said refusal of the company to provide a job evaluation program to eliminate geographical inequities was instrumental in the union vote to strike. The Union had not demanded a specific wage increase. The refinery had been producing about 3,000 tons a week.

The United Steelworkers agreed to a day-to-day extension of its contract with Kennecott Copper at the smelter and refinery at Garfield, Utah. The union made no specific wage increase demand. Kennecott offered 18c in a two-year contract; the USW then demanded 36c and threatened a strike for Aug. 10.

The Mine, Mill and Smelter Workers Union Wage Policy Committee was scheduled to meet in Denver August 2. The union had adopted the policy of working without a contract as long as negotiations made progress. Mine-Mill represents more metal miners than do other unions. Most of its contracts ended June 30. The policy committee is expected to decide how long its members will work without a contract and if sufficient progress has been made to justify not striking. Mine-Mill had asked for about 15c an hour wage increase at the properties of Kennecott, Asarco and Phelps Dodge where it has jurisdiction. At the Phelps Dodge El Paso refinery it asked for 17c.

Producer copper prices were cut 1½c a lb to 30c a lb delivered July 14. Kennecott announced July 13 the new price would be effective the following day. Phelps Dodge announced the same price a short time later and Anaconda on the 14th said its price would be 30c beginning July 15. No copper was sold at the 31½c price on the 14th. Prices of fabricated products also dropped.

Custom smelter and merchant prices had been coming down for several months. Custom smelters on the 13th had offered at 29c delivered. A few days earlier merchants had offered for delivery to Eastern points at 29c. London Metal Exchange prompt copper had dropped to about 26¼c per lb Friday July 10; on the 13th it was not significantly stronger.

Phelps Dodge simultaneously with its announcement of a price cut said it was cutting output 7% relative to its first half 1959 production. This, and the expectation other producers would cut output, raised quotations on the exchanges and prices charged by merchants and custom smelters. Smelters were up ½c to 29½c July 16.

Rhodesian Selection Trust companies in Africa about July 16 said they would reduce output 10% from the first half 1959 level. Other major copper companies did not indicate they would cut output. But strikes show signs of bringing about involuntary cuts. Anaconda's smelter at Potrerillos was struck for about 15 days during which about 3,000 tons of blister was "lost."

The copper price outlook is not as bad as in 1957. Real consumption in the U.S. is high and prospects for the economy are good. Industrial activity is improving in Europe. World stocks are not excessively high. The slowness with which industry cut output in 1957 and 1958 is still fresh in mind and if widespread strikes do not cut production in August then more voluntary cuts by producers are possible. The view that production flexibility can prevent too great price flexibility is now widely held in industry.

World stocks of refined copper dropped 5,733 short tons in June according to the Copper Institute. Blister stocks increased by about as much. Deliveries to fabricators were 294,909 tons—the exceptionally high figure reflected shipments in anticipation of copper strikes but good business conditions also were pertinent. Mine production was 277,158 tons and refined output was 284,278.

Strikes in aluminum in the U. S. are unlikely. The four largest aluminum producers and the United Steelworkers Union agreed to extend present contract terms until 30 days after a steel agreement or until November 1. If by then there is no agreement either party may on ten days' notice end the arrangement. Alcoa, Kaiser, Reynolds, and Ormet signed. In addition, a fabricator, Olin-Mathieson, that is part owner of Ormet, signed. Alcoa arranged about the same terms with the Aluminum Workers International Union.

Net shipments of aluminum mill products rose about 13,000 tons to about 160,000 tons in May according to the Census Bureau. This is a record high. June primary output in the U. S. according to the Aluminum Association was 167,323 short tons. This is about 3,500 tons over May and is about equal to the increased capacity as Kaiser brought into operation a new potline at Ravenswood. The industry operating rate in June was 87%, unchanged from May.

Price increases in aluminum when new labor contracts are signed are expected. Spokesmen for the various companies have indicated they believe even without further cost increases prices should be raised. Pig prices are now 1.3c a lb under what they were more than a year ago. Many analysts believe the aluminum companies will raise by about this much. Some have pointed out that prices are actually better now than for possibly two years. The discounts at which so much aluminum was being sold have been practically eliminated (E&MJ July 1959, p 22).

Lead sales in July were exceptionally low. Sales reported to E&MJ for calculating weighted average prices were the lowest of the year. In part the low sales reflect inventory building in April and May. This had been in anticipation of higher prices and of strikes.

Prices in London were fairly steady in July; most of the month they were about 8¾c with some firming to about 9c July 22.

Bunker Hill president John D. Bradley told Mine-Mill that when the combined price of lead and zinc reached 29½c a lb, the price when the last labor-management contract was signed, the company would consider higher wages and other benefits. The union has extended the present contract until August 31. Fifteen Senators indicated they were asking the Tariff Commission to make another study looking toward changing the import duties or quotas on lead and zinc. Ordinarily the Senate Finance Committee would make the request. There are reports an attempt may be made to get the full Senate to request the study. The Commission Aug. 4 said it will study lead and zinc product imports. It need not make a recommendation of action.

Zinc sales reported to E&MJ for computing weighted average prices dropped in July to about the February level, the lowest month of the year. The low figures reflected inventory accumulation in May and June and a drop in sales of Prime Western owing to the steel strike. Some sellers report some customers were well stocked with higher grades and that buying has slumped off a little in these.

Zinc was rather firm in Europe most of the month. July 31 the LME was at about 10.3c. With the 0.7c import duty and about the same for ocean freight this is about ¼c above New York Prime Western. Special High grade usually is only above the Prime Western grade by about ¼c in Europe so it is still under Special High in the U. S.

American Zinc Institute data for June showed shipments up nearly 17,000 tons and stocks down more than 26,000 tons. Special High Grade shipments were 45,374 tons, about 11,000 tons above May, the highest in at least four years and probably a record high.

New Jersey Zinc and the United Steelworkers agreed to a one-year contract at the company's Palmerton, Pa. Zinc smelter and its Gilman, Colorado mine. The workers received an 8c an hour wage increase.

Average Prices July (E&MJ Quotations)

Copper:	
Electro, domestic refinery	30.077
Electrolytic, export refinery	26.732
Electrolytic, c.i.f. Cont'l ports	27.677
Lead:	
Common, New York	12.000
Common, St. Louis	11.800
Silver:	
Silver, New York, per oz.	91.375
Silver, London, pence per oz.	78,261
Zinc:	
Prime, Western, East St. Louis	11.000
Prime, Western, delivered (g)	11.500
Tin:	
New York Straits	102.380
Gold, per oz., U. S. price	$35.000
Sterling Exchange	281.165
Quicksilver, per flask	$236.130
Antimony (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$77.000
Cadmium (a)	120.000
Cadmium (b)	130.000
Al., 99½ dom., ingot	26.800
export, pag.	22.500
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Per lb. delivered, ton lots.
(b) Per lb. delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

Free Gold Market

International gold trading volume rose 14½% in July. London led in turnovers followed by Paris and Swiss markets. Prices fluctuated moderately in Europe but declined sharply in Bombay and Karachi. No Russian gold sales were reported. U.S. gold losses continued reducing stocks to their lowest level in almost 20 years. Near East markets were moderately active while South American centers were quiet. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	June 30	July 31	June 30	July 31
NEW YORK				
transit	.....	.....	$35.08½	$35.08½
MANILA	$42.00	$42.00	36.20	36.00
HONG KONG	46.50	46.40	38.75	37.50
BOMBAY	63.00	57.50	62.50	56.00
TANGIER	40.75	40.55	35.25	35.25
BEIRUT	40.50	40.60	35.18½	35.18½
PARIS	40 40	40.50	35.40	35.47
BUENOS AIRES	38.25	38.75	36.25	35.05

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average prices sales in U. S. for month of July reported by American Smelting & Refining Co.; electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered Consumers' plant	29.500 lb
F.o.b. refinery	29.100 lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

July 1959	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99% U. S. Dest.	Straits Tin New York
1	31.050	26.700	27.645	12.000	11.800	11.500	11.000	24.700	103.125
2	31.075	26.975	27.920	12.000	11.800	11.500	11.000	24.700	103.000
3	31.100	26.650	27.595	12.000	11.800	11.500	11.000	24.700	102.875
6	31.100	26.800	27.745	12.000	11.800	11.500	11.000	24.700	103.000
7	30.800	26.450	27.395	12.000	11.800	11.500	11.000	24.700	103.000
8	30.975	26.275	27.220	12.000	11.800	11.500	11.000	24.700	102.875
9	30.675	26.050	26.995	12.000	11.800	11.500	11.000	24.700	103.000
10	30.900	25.675	26.620	12.000	11.800	11.500	11.000	24.700	102.750
13	30.700	25.575	26.520	12.000	11.800	11.500	11.000	24.700	102.625
14	29.475	25.625	26.570	12.000	11.800	11.500	11.000	24.700	102.250
15	29.550	26.375	27.320	12.000	11.800	11.500	11.000	24.700	102.250
16	29.375	26.000	26.945	12.000	11.800	11.500	11.000	24.700	102.000
17	29.500	27.325	28.270	12.000	11.800	11.500	11.000	24.700	102.250
20	29.500	27.125	28.070	12.000	11.800	11.500	11.000	24.700	102.125
21	29.500	27.000	27.945	12.000	11.800	11.500	11.000	24.700	102.125
22	29.600	26.975	27.920	12.000	11.800	11.500	11.000	24.700	102.250
23	29.550	27.025	27.970	12.000	11.800	11.500	11.000	24.700	102.125
24	29.575	27.125	28.070	12.000	11.800	11.500	11.000	24.700	102.000
27	29.550	27.200	28.145	12.000	11.800	11.500	11.000	24.700	101.875
28	29.575	27.450	28.395	12.000	11.800	11.500	11.000	24.700	102.000
29	29.550	27.600	28.545	12.000	11.800	11.500	11.000	24.700	101.750
30	29.575	27.350	28.295	12.000	11.800	11.500	11.000	24.700	101.625
31	29.525	27.500	28.445	12.000	11.800	11.500	11.000	24.700	101.875
AVERAGES FOR MONTH									
July	30.077	26.732	27.677	12.000	11.800	11.500	11.000	24.700	102.380
AVERAGES FOR WEEK									
July									
1	31.060	26.735	27.680	12.000	11.800	11.500	11.000	24.700	103.375
8	31.010	26.630	27.575	12.000	11.800	11.500	11.000	24.700	102.950
15	30.260	25.860	26.805	12.000	11.800	11.500	11.000	24.700	102.575
22	29.495	26.885	27.830	12.000	11.800	11.500	11.000	24.700	102.150
29	29.560	27.280	28.225	12.000	11.800	11.500	11.000	24.700	101.950
CALENDAR WEEK AVERAGES									
July									
3	31.055	26.755	27.700	12.000	11.800	11.500	11.000	24.700	103.100
10	30.890	26.250	27.195	12.000	11.800	11.500	11.000	24.700	102.925
17	29.720	26.180	27.125	12.000	11.800	11.500	11.000	24.700	102.275
24	29.545	27.050	27.995	12.000	11.800	11.500	11.000	24.700	102.125
31	29.555	27.420	28.365	12.000	11.800	11.500	11.000	24.700	101.825

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.0400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western: Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

July 1959	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	78.250d.	281.2300	249s. 7½d.
2	91.375	78.250d.	281.2000	249s. 9½d.
3	91.375	78.250d.	281.2100	249s. 9d.
6	91.375	78.000d.	281.2400	249s. 8½d.
7	91.375	78.000d.	281.2300	249s. 9½d.
8	91.375	78.000d.	281.2200	249s. 9½d.
9	91.375	78.000d.	281.2200	249s. 9½d.
10	91.375	78.000d.	281.1400	249s. 10d.
13	91.375	78.125d.	281.1400	249s. 10½d.
14	91.375	78.125d.	281.1600	249s. 11d.
15	91.375	78.125d.	281.1960	249s. 10⅝d.
16	91.375	78.250d.	281.1900	249s. 10⅝d.
17	91.375	78.250d.	281.1900	249s. 11d.
20	91.375	78.250d.	281.1900	249s. 11d.
21	91.375	78.250d.	281.1400	249s. 11⅛d.
22	91.375	78.250d.	281.1200	249s. 11⅛d.
23	91.375	78.250d.	281.0900	249s. 11⅛d.
24	91.375	78.250d.	281.1100	249s. 11⅛d.
27	91.375	78.625d.	281.1500	249s. 10⅛d.
28	91.375	78.625d.	281.1700	249s. 9⅜d.
29	91.375	78.625d.	281.1200	249s. 10⅛d.
30	91.375	78.625d.	281.0900	249s. 10½d.
31	91.375	78.625d.	281.0600	249s. 11¼d.
AVERAGES FOR MONTH				
July	91.375	78.261d.	281.165	—
AVERAGES FOR WEEK				
July				
1	91.375	—	281.330	—
8	91.375	—	281.220	—
15	91.375	—	281.171	—
22	91.375	—	281.166	—
29	91.375	—	281.128	—

Calendar Week Averages: New York Silver: July 3, 91.375; July 10, 91.375; July 17, 91.375; July 24, 91.375; July 31, 91.375.

MARKETS *(Continued)*

London Metal Exchange Quotations

July	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	222½	222¾	222¾	223	69¾	70	71	71⅛	80¼	80⅜	79	79¼	790½	791	792½	793
2	220¾	221	221½	221¾	69¼	69⅜	70½	70⅝	80¼	80¾	79	79¼	790½	791	792½	793
3	221	221¼	222	222¼	69⅞	70	71⅛	71¼	80¼	80½	79	79⅛	791	791½	792½	793
6	219¼	220	220¾	221	68¾	69	70½	70¾	80	80¼	78¾	79	791½	792	793	793¼
7	215¾	216	217	217½	68¾	68½	70	70½	80	80¼	78¾	79	791½	792	792½	793
8	214¼	214½	215½	216	69	69¼	70¼	70½	80¼	80⅜	79⅜	79¼	791	792	792	792½
9	214¾	215	215¾	216	69	69¼	70¼	70⅜	79¾	80	79	79⅛	791	792	791½	792
10	209¼	209½	210½	210¾	68¾	69	70⅛	70¼	79⅝	79⅞	78¾	79	791½	792	791	791½
13	210¼	210½	211¾	211½	69⅜	69¾	70½	71	80	80¼	79¼	79½	791½	792	789	789½
14	216	216¼	217¼	217¾	70	70¼	70⅝	70⅞	79¾	79⅞	79	79½	791	793	788½	789
15	219½	219¾	221	221½	70	70⅛	70⅝	70¾	79⅝	79⅞	79⅛	79¼	791½	793	789½	790
16	226½	227	227½	228	70⅛	70⅛	70¾	70⅞	79¾	80	79⅛	79⅜	792	793	790	790½
17	224	224¼	225½	225¾	70⅛	70¾	71	71⅛	79⅜	79⅞	79	79½	792½	793½	790	791
20	222	222½	223¾	223½	71⅛	71⅛	71¾	72	79⅜	79½	78¼	78⅝	793½	794	790	790½
21	221¼	221½	223	223¼	71⅜	71⅞	72	72½	79½	79¾	78⅞	79	793½	794	790	790½
22	221¾	222	223½	223¾	72¾	72⅞	72¾	72⅞	79¾	80	79⅜	79½	792½	793	790	790½
23	224	224¼	225¼	225½	71½	71⅜	71⅝	71¾	80⅛	80½	79⅝	79⅞	792½	793	790	790½
24	224¼	224½	224¾	225	70⅞	71	71½	71¾	80⅛	81	80½	80¾	792½	793	789	789½
27	226	226¼	225⅝	226	71¼	71½	71⅝	71⅞	81½	82	81⅜	81½	793	793½	789	789½
28	227½	228	227½	227¾	71¼	71⅝	71⅝	71⅞	82⅛	82½	81⅝	81⅞	793	793½	790	791
29	226	226¼	225⅝	226	70⅞	70¼	71	71⅛	81½	82	81	81½	792½	793	790	791
30	224¾	225	224½	224¾	69⅞	70	70⅞	71	82	82¼	81	81¼	792½	793	789	790
31	225¼	225½	225	225¼	69¾	70	70¼	71¼	82⅝	82¾	81⅝	81⅞	793	793½	790½	791
Av'g's	£220.875		£221.739		£70.250		£71.060		£80.530		£79.666		£792.326		£790.815	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

July 31, 1959

Aluminum ingot, 99 plus % lb.			26.8¢
Antimony, spot, lb., less than carload, in cases			32.59¢
In bulk, carload lots, f.o.b. Laredo			29.00¢
Imported, 10 ton min. (p), 99½%			24¢
Bismuth, ton lots, lb.			$2.25
Cadmium, small lots, commercial sticks, delivered, lb.			$1.20
small lots			$1.30
Calcium, lb., ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb., contract del.			$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957			$1.75
Germanium, per gram, 10,000 gram lots	(d) 33¢	@(c)(d)	35¢
Indium, troy oz.	$1 25	@	$2.25
Lithium, lb., 98%	$9 00	@	$11.00
Nickel, cathodes, lb. (a)			74¢
Other sales, reg. sellers			74¢
Sales by dealers, etc.			74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16			35¼¢
Palladium, troy oz.	$18.00	@	$20.00
Platinum (wholesale lots), troy oz.	$76	@	$80
Quicksilver flask of 76 lb. 25 flasks or more	$234	@	$236
Selenium, 99 plus %, lb.—(Feb. 19, 1958)			$7.00
Silicon, minimum 98%, carloads, lb.			19¢
Semi Conductor grade, lb.			$360
Tellurium, lb.			$2.50
Thallium, 100 lb. or more lb.			$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)	$1.50	@	$1.60

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Eff. Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, Imported, 10% BeO, (b) stu: spot			$31
term contracts			$31.50–33
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$18	@	$19
48% Cr_2O_3 3 to 1 ratio	$35	@	$39½
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.85(c)
Mesabi bessemer			$11.60(c)
Mesabi non bessemer			$11.45(c)
Lead (Galena), 80%, Joplin, Mo., ton			$141.72
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S ports import duty extra. 87¢—90¢. Long-term contract nominal. Indian Gov't export duty discontinued Nov. 24, 1958.			
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines			$1.25
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1 10	@	$1.15
Tungsten Ore, per stu of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra			$12–12.25
U. S. scheelite, f.o.b. mill	$20½	@	(a)$22
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$64

(a) Nominal. (b) c.i.f. U. S. ports. (c) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots N. Y. docks			4–5¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.33	@	$1.36
Copper Sulphate, 100 lb. eff. July 14, '59			$11.95
Germanium Dioxide, gm.			18½¢
Molybdic trioxide, technical, per lb. of Mo	$1.46	@	$1.47
Imported, incl. 37¢ duty	$1.75	@	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr, (4-9% C)			28½¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.			12½¢
Ferramolybdenum, 58 to 64% Mo lb. of Mo contained	$1.50	@	$1.82
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957)			14.60¢
Ferrotungsten, 72 to 82%, lb. of W contained			$2.15
Ferrovanadium, per lb. of V delivered	$3.20	@	$3.40
Silicomanganese, max. 1½% carbon, lb. contracts			12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7			$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400	@	$1,810
Crude No. 2	$750	@	$1,155
Spinning fibers	$370	@	$600
Shingle fibers	$180	@	$220
Paper stock	$120	@	$145
Waste	$75	@	$86
Shorts	$40	@	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1			$1,522
Spinning fibers	$220	@	$787
Asbestos, Vermont, f.o.b. Morrisville:			
Spinning fibers	$370	@	$428
Shingle stock	$181	@	$200
Paper stock	$120	@	$152
Waste, stucco or plaster			$86
Refuse or Shorts	$41	@	$75
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94%, BaSO, per short ton	$16	@	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)			$18
Imported, c.i.f. Gulf Ports, st	$16	@	$18
Bauxite, long ton, f.o.b. point of shipment:			
Domestic, crude, 50 to 52% (not dried) (c)	$ 5.00	@	$5.50
Domestic, chemical, 55 to 58% (c)	$ 8.00	@	$8.50
Domestic, abrasive, 80 to 84% (c)	$18.00	@	$18.50
Imported metallurgical, per lt. f.o.b. Br. Guiana, dep. on grade			$7.14
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade			$20.50–$21
Glass feldspar, white, 20 mesh			$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37	@	$41
60% effective CaF_2	$33	@	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)			$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$46

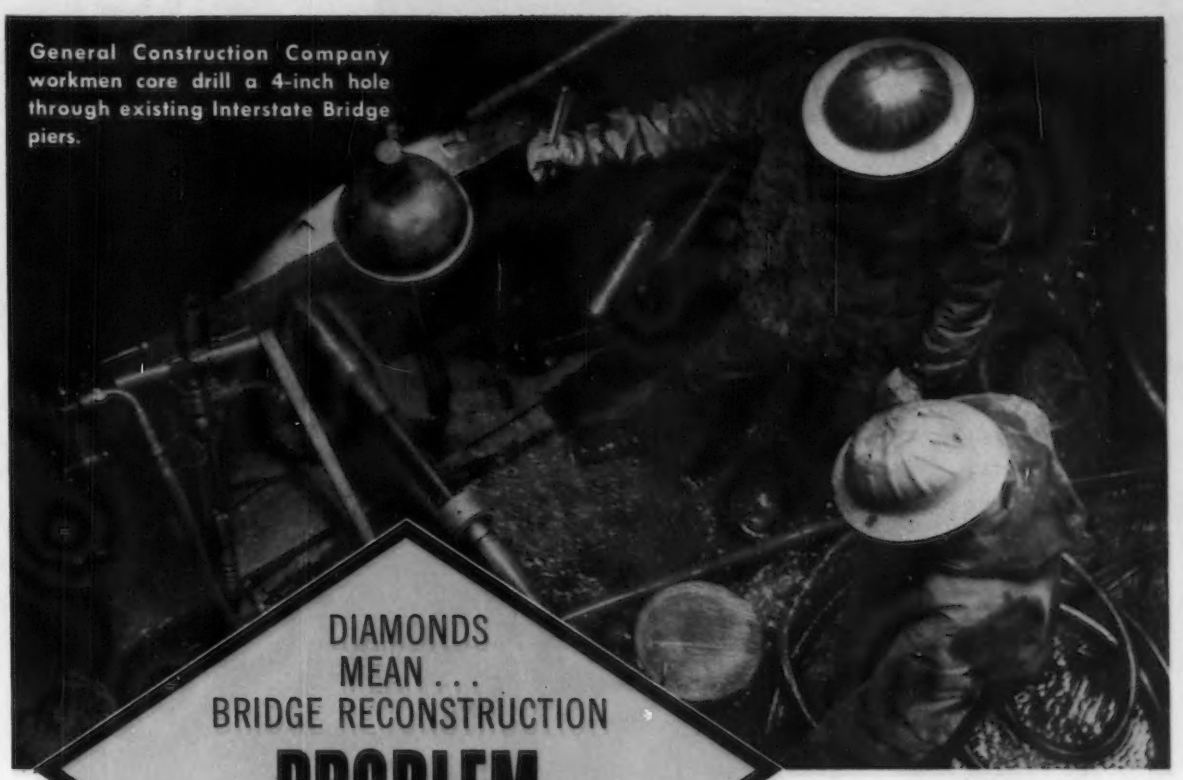
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; x 2 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton, Bulk sales, dry ground; $30 @ $55 per ton. Scrap $20 @ $30.

Ocher, Georgia, ton in sacks	$26.50	@	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports			Not quoted
Sulphur, per lt. f.o.b. U. S. mines: bright			$23.50
dark			$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40	@	$31.60
For export f.o.b. vessel, lt. dep. on grade	$22	@	$24
Talc, f.o.b. works, ton:			
New York, purified	$18.00	@	$20.00
Vermont, extra fine			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$66.00
Steel, f.o.b. Pittsburgh, billets, net ton			$80.00
Structural shapes, Pa., Ala., etc. 100 lb.	$5.30	@	$5.50



General Construction Company workmen core drill a 4-inch hole through existing Interstate Bridge piers.

DIAMONDS MEAN . . . BRIDGE RECONSTRUCTION

PROBLEM SOLVED!

Christensen Custom Designed Diamond Equipment Aids in Interstate Bridge Reconstruction

Raising the Interstate Bridge between Portland, Oregon and Vancouver, Washington is a mammoth job that demands specialized equipment. The reconstruction of the Interstate Bridge is under the supervision of the Oregon State Highway Department, A. A. Rear, Resident Engineer. Aimed at providing additional vertical clearance for Columbia River traffic, five concrete piers are being heightened as much as 38 feet, requiring enlargement of their bases with new concrete. To tie the new concrete to the old, 45 holes were core drilled. These holes were 14 feet long and four inches in diameter to allow insertion of heavy steel rods. These tensioned rods, projecting six feet from each end of the holes, assure proper adherence of the new concrete to the existing bases. The special bit and core barrel necessary for this job were designed and manufactured by Christensen under the supervision of T. R. Harris, General Superintendent, General Construction Company of Portland. This unique equipment was specifically designed to operate economically in a confined space 40 feet below the river surface. Maximum efficiency and complete customer satisfaction were achieved.

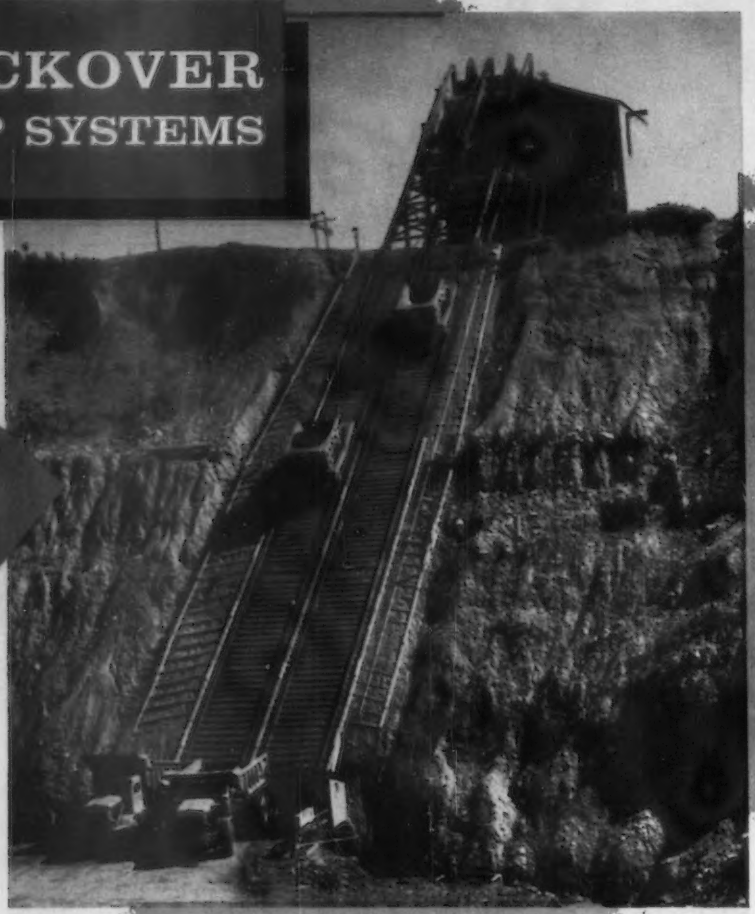
If you have a unique operation or a particularly difficult drilling problem that requires specialized equipment, consult Christensen about diamond drilling equipment manufactured to your requirements.

Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

Elevate materials at LOWEST COST PER TON with ROCKOVER SKIP SYSTEMS



IN USE SINCE 1949

The ROCKOVER SKIP SYSTEM has proven to be the most economical method to elevate materials from open pits. It uses the shortest and fastest hauling route, has the lowest operating and maintenance costs and requires no large investment in parts and standby equipment.

Rockover Skip Systems require no expensive wide roads for pit access and require a minimum of personnel . . . are flexible to follow pit bottom as operations go deeper . . . haul either waste or ore at anytime . . . may be loaded at any desired bench and require no sizing equipment in the pit.

NICO SKIPS FROM 15 TO 50 TON CAPACITIES AVAILABLE

Write for illustrated brochure.

NATIONAL IRON COMPANY

50th Avenue West and Ramsey Street • Duluth 7, Minnesota

Subsidiary of Pettibone Mulliken Corp., Chicago 51, Illinois

Mobile Tournatractor cleans-up around 7 widely-separated shovels . . .

2 Cleans-up pit-floor after blasting . . .

3 Levels and compacts stockpiles . . .

TOURNATRACTOR® SOLVES "SPACE PROBLEM"

at large limestone quarry

4 Handles clean-up at waste dumps . . .

At Texas, Maryland, the Harry T. Campbell Sons' Corporation operates one of the largest limestone quarries in the eastern states. With a half-dozen shovels, and numerous stockpiles over a considerable area, the firm once kept 2 crawler tractors busy on maintenance and clean-up work. But like all track-type tractors, the rigs spent about as much time just going from job-to-job as they did working.

"We bought Tournatractors to do the work of a crawler tractor whose main job was to clean-up the quarry floors," says Superintendent Eddie Reichert. "It really moves around our pit and does a grand job."

Owners of the Harry T. Campbell Corp. agree. "It's Tournatractor's speed that does the trick," says Mr. Campbell . . . "Tournatractor completes the clean-up job so fast, that it is available to do many other jobs throughout the quarry operation. In addition this rubber-tired tractor requires less maintenance than any track-type tractor."

Illustrated and described here are some of the jobs handled by this "go-anywhere", rubber-tired LW tractor during a single work shift.

5 Cleans-up around crusher-grizzly as well as polices entire plant area . . .

6 Maintains haul roads as it "runs" from one job to the next . . .

See it in action

Let us show you how 17.2-mph Tournatractor can save you money on widely-separated dozing, towing and pushing jobs. Ask us for complete facts and a demonstration.

CT-2025-MQJ-1

LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Has no springs, rides on Hydrair®

Pounded over 200 times by air hammer . . . still not cut!

Even after steady pounding with an air hammer, which delivered 80 pounds of pressure to the chisel edge, Gold Seal air hose was still intact! Think of how much you will save on costly replacements should your operator accidentally hammer Gold Seal for a few seconds . . . or a trucker dump a load of rock on it . . . or a tractor grinds over it.

A. COVER: Extremely tough, resilient rubber; resists abrasion, cutting and gouging.

B. CARCASS: Braided steel wire for maximum strength and resistance to extreme impacts. Single braid of nylon cord to insure maximum bonding of cover to carcass.

C. TUBE: Synthetic compound to insure maximum oil resistance. Won't soften or flake.

Write Dept. E. for more information.

Acme Hamilton

Serving Industry Since 1870

MANUFACTURING CORPORATION, TRENTON 3, N. J.

Divisions: Acme Rubber Mfg. Co. • Hamilton Rubber Mfg. Corp.

ATLANTA • CHICAGO • DETROIT • HOUSTON • INDIANAPOLIS • LOS ANGELES
MILWAUKEE • NEW YORK • PITTSBURGH • SALT LAKE CITY • SAN FRANCISCO • SEATTLE

Has no springs, rides on Hydrair*

— With Haulpak's exclusive air-hydraulic suspension system, you completely eliminate maintenance and repair of springs. 4 Hydrair units cushion against loading and travel shocks . . . keep unit riding level over bumps and holes. LW Haulpak also has exclusive LW power-transfer differential — permits unit to haul over wet, muddy areas that bog down competitive trucks.

You'll haul more tons per hour at lower cost . . . with LW Haulpak®

Low loading height — (only 10'1" on 32-ton size) and large top opening (14'5" x 11') makes it easy to load LW Haulpak *fast*, without spillage.

This revolutionary off-highway truck gives you highest output at lowest ownership and operating costs. You get these profit-making benefits because the all-new, fully-proven LeTourneau-Westinghouse Haulpak is built *specifically* for rugged, heavy-duty hauling. It is not a "beefed-up" highway truck . . . nor does Haulpak have the maintenance problems common on ordinary haulers.

Notice, for example, Haulpak's rugged "V"-shaped body. This exclusive LW design gives you *bonus* yardage within a short wheelbase . . . makes for easy loading . . . and provides a low center of gravity for exceptional stability.

LW Haulpak's short, 130-inch wheelbase gives you unusual maneuverability (makes non-stop U-turn in area only 44'6" wide . . . shortest turning radius of any big off-road truck). You spot, swing around, back up and dump *fast* . . . you eliminate most maneuvering delays, complete faster cycles. You have "feather-touch" power-steer, too . . . system is located high behind bumper, well protected from damage.

And, very important, time lost for maintaining your Haulpak is practically nil. It needs *no* daily lubrication. The entire Haulpak lubrication check — *needed only at 500-hr intervals* — consists of just 4 easily-reached grease fittings. In addition, LW Haulpak's various parts and assemblies — some of them tested and proved by *millions of hours* on LW Tournapulls® all over the world — are much stronger than those used on competitive haulers.

22, 27, 32-ton sizes

Ask us for detailed specifications on the size Haulpak that fits your needs. Available in 22, 27, and 32-ton sizes . . . 290, 335, and 375 hp. Compare its features with any other truck in the industry . . . you be the judge!

*Trademark HP-2155-G-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

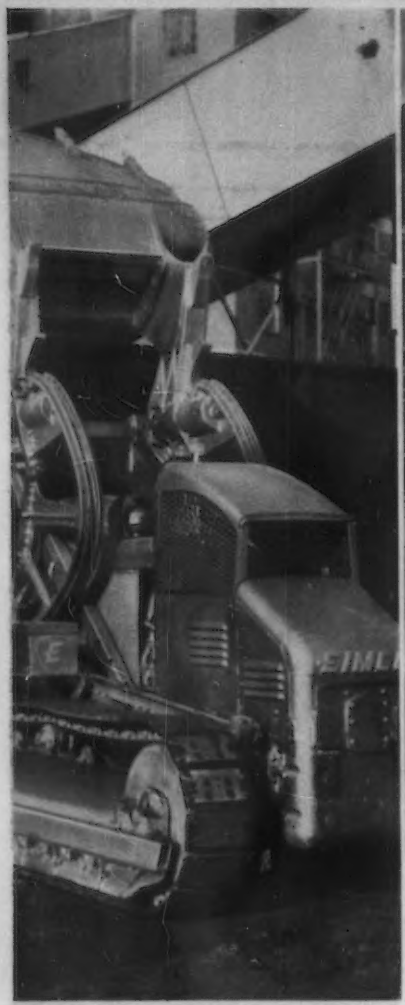
Where quality is a habit

PROFIT NEWS FOR POWER USERS IN THE

all purpose power line

(20 TO 1650 H.P. IN ONLY 3 CYLINDER SIZES)

Now you can enjoy all the benefits of GM Diesel standardization in every type of equipment and still buy the best makes of equipment on the market



GM Diesel engines are offered in more than 1800 applications of power equipment built by over 250 leading manufacturers—wider availability than any other Diesel.

Only by standardizing on GM Diesel will a user get *all* the benefits of engine standardization—for *only* GM Diesel covers the entire power range with only 3 cylinder sizes.

Widest parts interchangeability pays off for operators in lower parts inventory requirements—many parts for a 33 H.P. "Jimmy" Diesel fit a 1650 H.P. "Jimmy."

GM DIESEL

PARTS AND SERVICE WORLDWIDE

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario

DETROIT DIESEL ENGINE DIVISION, GENERAL MOTORS, DETROIT 28, MICH.

Use same L-W prime-mover in stripping and hauling

You save on original equipment investment . . . and reduce operating costs

Stripping overburden is different from mining out pay ore or rock. It is basically a *scraper* job—can be handled most economically by modern scrapers. They leave your shovels and haulers free to maintain steady production.

Yet, since stripping is not a continuous operation in most pits, you need a multi-purpose machine—one that can quickly switch over to hauling shovel-loaded material when you catch up on stripping of overburden.

You get this advantage with the LeTourneau-Westinghouse Tournapull® line. These L-W machines keep equipment investment and operating costs low *all year long* because of their interchangeability feature (see panel). The prime-mover—major part of your original machine investment—interchanges with a variety of profit-making work trailers for other specialized duties. They handle your stripping, land-leveling, roadbuilding, pit-hauling, and waste product disposal efficiently, and at low cost.

Cut costs on your operation

The next time you consider investing in new stripping or hauling machinery, investigate Tournapull. Ask about the multiple work bonus you get (at fractional cost) from its interchangeable L-W trail units. Ask for specifications and prices on all 3 sizes. All have road speeds of close to 30 mph, ability to turn 180° non-stop in less than their own length.

L-W Tournapull Scrapers in 3 Sizes

Size	Diesel HP	Maximum MPH	Bowl Yards	Capacity Tons
B	335*-325	30.0	28	32.5
C	210	29.9	18	20.0
D	138	29.5	9	10.0

*when torque converter is specified

Interchangeable Rear-Dump

Tournapull scrapers interchange with other L-W trailing units behind the same prime-mover. For pit work, the Rear-Dump offers economical hauling ability, and simple operation — plus all the advantages of Tournapull speed and mobility. Bowl capacities are 35, 22, and 11 tons. Other L-W trailing units, suitable for pit and quarry work, include bottom-dump and side-dump haulers.

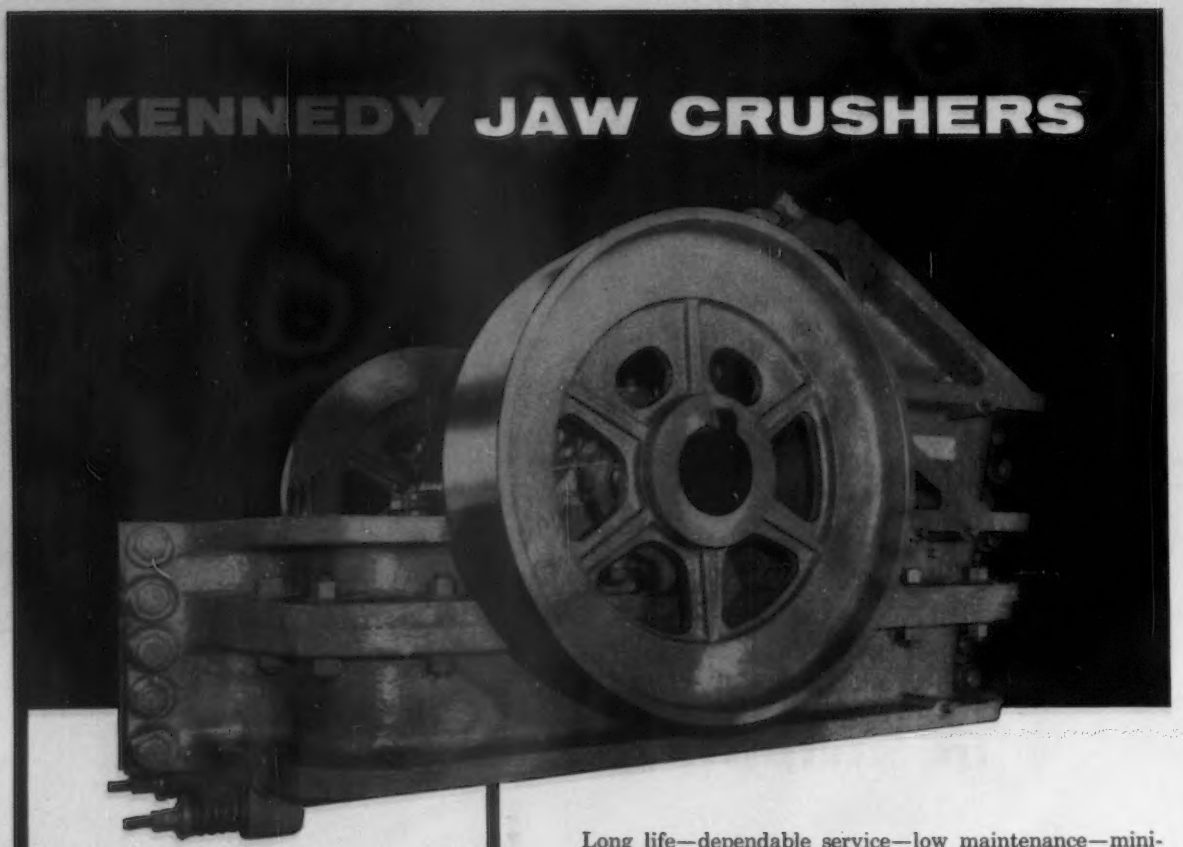
P-1860-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

KENNEDY JAW CRUSHERS



The KENNEDY Overhead Eccentric Jaw Crusher features a massive, one-piece, arc welded steel plate frame, and is available in standard sizes from 10″ x 36″ to 36″ x 42″.

Long life—dependable service—low maintenance—minimum power—high production—make KENNEDY Jaw Crushers the first choice of all who buy because of proven performance and low year-to-year cost.

Exclusive features of the KENNEDY Jaw Crusher

- Cast Meehanite or steel frame.
- Counterbalanced flywheel lifts pitman at bottom of stroke. Makes starting easier.
- Split frame design distributes stresses evenly. There can be no failures at the corners.
- No loss of power due to "weaving" and misalignment common to ordinary 4-piece crusher frames.
- Rocking toggles require no lubrication.
- Each jaw bears exactly half the load because both are mounted at the same angle. No power is wasted in lifting the charge.
- Jaw plates are interchangeable and reversible. Shaft is integral with swing jaw.
- Available in standard sizes from 7″ x 10″ to 66″ x 84″.

Send for complete information on KENNEDY Crushers.

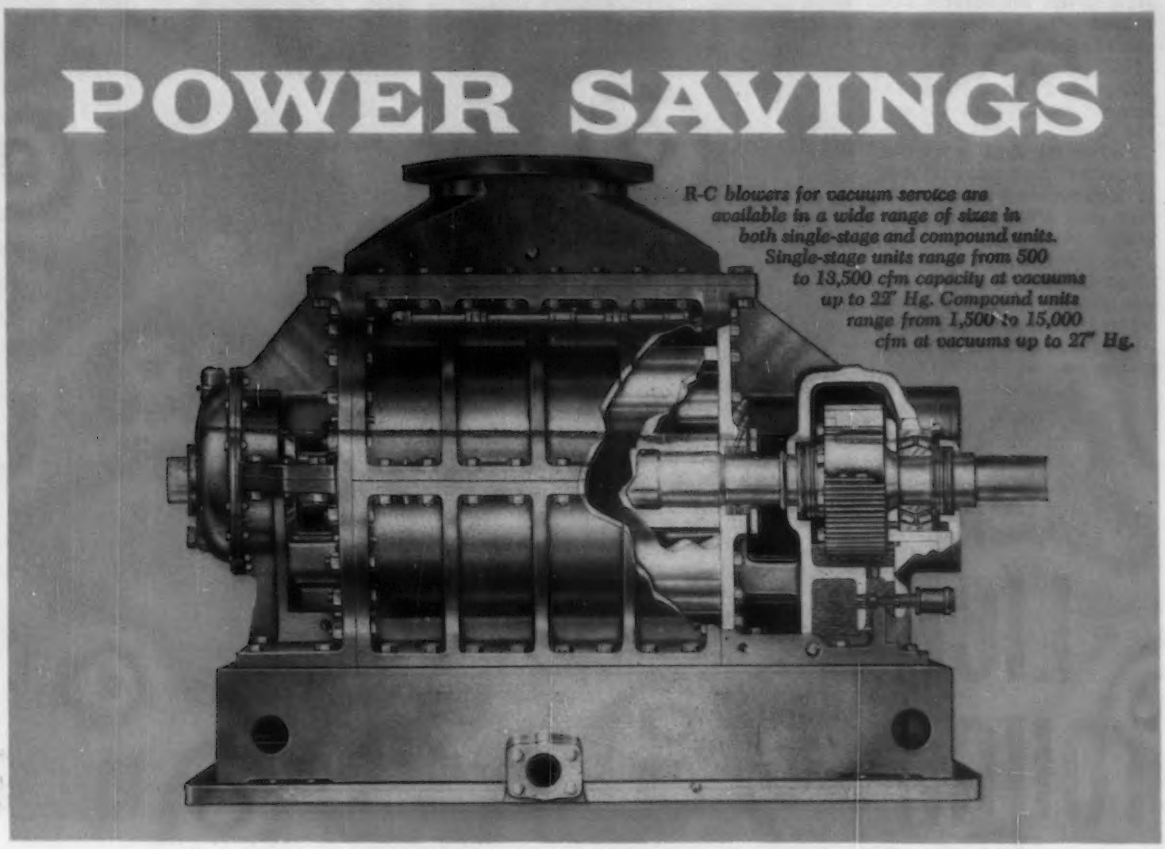
KENNEDY VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.

Primary & Secondary Gyratory Crushers • Jaw Crushers • Roll Crushers • Impact Breakers • Hammer Mills • Rod & Ball Mills • Kilns • Dryers • Screens • Mechanical & Pneumatic Conveyors • Complete Crushing, Lime, Cement & Carbon Paste Plants. KENNEDY Research & Testing Service.

POWER SAVINGS



R-C blowers for vacuum service are available in a wide range of sizes in both single-stage and compound units. Single-stage units range from 500 to 13,500 cfm capacity at vacuums up to 22" Hg. Compound units range from 1,500 to 15,000 cfm at vacuums up to 27" Hg.

...up to 25% with R-C Cycloidal Blowers for Vacuum Service

Because R-C cycloidal blowers for vacuum service operate at higher speeds with reduced horsepower, power savings of as much as 25% are often possible. Their simple design and rugged construction assure superior performance, low maintenance and long life. These advantages derive from the high volumetric efficiency of the design, low mechanical friction and installation flexibility. Minimum sealing water effectively overcomes slippage loss . . . as little as 4 gpm may be required.

R-C blowers for vacuum service are used throughout the world in a large number of industries. In chemical processing, R-C blowers have many applications in the handling of nitrogen, hydrogen, acetylene, moist air with SO^2, and other oil and gas mixtures. In paper-making, R-C blowers supply vacuum for suction rolls. In mining, R-C blowers provide vacuum for flotation, filtration and other ore processing requirements. And throughout general industry, they are used for carburetor testing, pneumatic conveying, food processing, cigarette tipping machines, aircraft component testing and many other applications.

For additional data, please refer to pages 565-568 in **CHEMICAL ENGINEERING CATALOG,** *our section in* **MECHANICAL CATALOG** *or write for* **Bulletin VP-158.**

Only Roots-Connersville vacuum equipment offers so many advantages – exclusive rotary positive design, ease of installation, efficiency of operation, and long years of trouble-free service. These features are the result of R-C's specialized experience of more than 100 years in the design and application of air and gas handling equipment.

ROOTS-CONNERSVILLE BLOWER
DIVISION OF DRESSER INDUSTRIES, INC.
859 Washington Avenue, Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto

NEW CP-65 AIR-DRIVEN DIAMOND DRILL handles with the ease of a drifter, because it's only 42½" overall and weighs just 200 pounds. Due to a big 20% increase in motor power over the world-famous CP-55, the CP-65 is the most productive, fastest and most powerful drill in its class. Coring Capacity 600-feet with EW rods and EX fittings.

Air motor requires minimum air per foot drilled and is reversible, permitting rapid unscrewing and screwing of rod joints . . . quick return of chuck to drilling position.

LICK TOUGH FORMATIONS AND TIGHT SCHEDULES WITH

CP "POWER VANE" ROTARY COMPRESSORS are available in capacities from 125 to 900 c.f.m. You can't buy a more dependable air supply. Compact and easy to start, they stay on the job until you say stop. Smooth running, economical performers, these "Power Vane" Rotary Compressors can be supplied with gasoline or diesel engine drive.

Set-up CP Drilling Equipment under the toughest conditions you have to face. Run it at top-rated capacity and watch it come through for you. Match its quick set-up time, hard hitting action, exceptional hole cleaning ability, against any equipment you've ever used. Whether you're doing exploratory, open-pit or underground work you'll find CP Drills built to lick your toughest jobs . . . help you beat tight schedules.

Other CP Drilling Equipment includes: Skid-mounted Diamond Drills, Stationary Air Compressors, Roof Bolting Equipment, Airlegs, Sinker Drills, Boom Arms, Shaft Sinking Jumbos, Pumps, and Air-powered Maintenance Tools all built to give . . . ease of operation—speed—safety.

NEWEST MEMBER OF THE CP LINE

The recent acquisition by Chicago Pneumatic of the REICH Brothers Manufacturing Company, Inc., with plants located in Terre Haute, Indiana, and Glasgow, Scotland, provides unexcelled diversification in blast-hole exploration, and water well Drilling Equipment.

REICHdrills, both truck and crawler mounted, are hydraulically-powered Rotary drills that are cutting drilling costs because of top hydraulic drive, infinitely variable drilling speed, easy one-man operation, quickest stem loading, dependable service.

REICHdrill
DIVISION: CHICAGO PNEUMATIC TOOL CO., NEW YORK

CP DRILLING EQUIPMENT

G-800 TRACDRIL is a self-propelled unit that moves readily from hole to hole. Easily pulls a 600 c.f.m. compressor up a 10% grade. This hard-slugging drill is equipped with the CP-450DR Deep-Hole Drill for sectional steel. Maximum capacity 3" holes to 75 feet. Fast acting hydraulic cylinders raise and lower drill carriage in seconds, also permit the driller to establish correct drilling angle on extremely bad ground and off level operations . . . gives him more productive drilling time. *The only machine on the market with automatic brakes.*

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

HYDRAULIC TOOLS • ROCK DRILLS • DIESEL ENGINES • AIR COMPRESSORS • PNEUMATIC TOOLS • VACUUM PUMPS • AIR BLAST BITS

How would you load rock this size?

Shoot to size? Cable and lift? Shovel?

There are only two tractor shovels in the business built for work like this . . . the Allis-Chalmers 225-hp, 4-yd HD-21G and the 150-hp, 3-yd HD-16G. They're in a class by themselves. If you move ore, rock, gravel or overburden . . . if you need a machine that will pioneer, rip, load and handle a multitude of jobs, see them in action. They'll go it alone or team up with other machines to help improve your profit.

Increase bidding power—You're way ahead in bidding flexibility with a big-capacity tractor shovel. Jobs miles away are simple transport operations with Allis-Chalmers BIG tractor shovels. Forget about expensive dismantling, problem loading, hauling and setup again at job site.

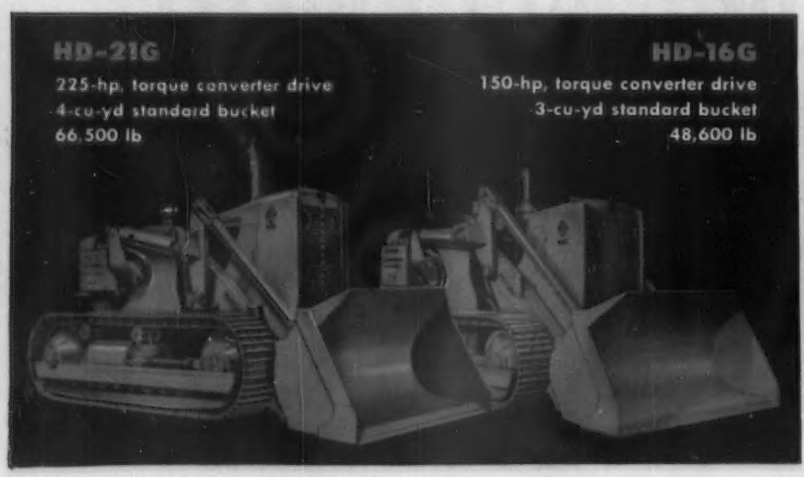
Handle scattered jobs economically—*Wherever* there's loading to do on a new job, these two dependable units "walk" to work . . . through mud—over rough terrain—those spots where *only crawlers* can go! They build their own roads—dozing, cutting, filling, compacting . . . load up to 4 yd at a clip*

What's more . . . BIG HD-21G's —16G's are not single-purpose units. They're pioneering machines. They'll open up new cuts or make quick work of clearing, piling stumps, brush or boulders. And, of course, loading, stockpiling and cleanup are their steady specialties.

They're ripping specialists—Long track, outstanding balance and power enable HD-21G's—16G's with rear-mounted Tractomotive rippers to open up tough material over *two feet deep*. Enough hydraulic penetrating pressure is developed to lift the tractor itself off the ground.

You *can afford* to use these big tractor shovels on many utility chores —from breaking up concrete roadbeds with 72,700-lb break-out force, to complete one-man, one-machine demolition operations. When you apply the abilities of the HD-21G—HD-16G to your own jobs, you'll see how either one or both of these production units can cut costs . . . put a *sharper point* on your favorite bidding pencil.

See your Allis-Chalmers dealer—He's the ONLY man with tractor shovels from 72 to 225 hp . . . from 1½ to 7¼ yd. He'll be happy to fill in the details—show you an Allis-Chalmers tractor shovel in action. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.

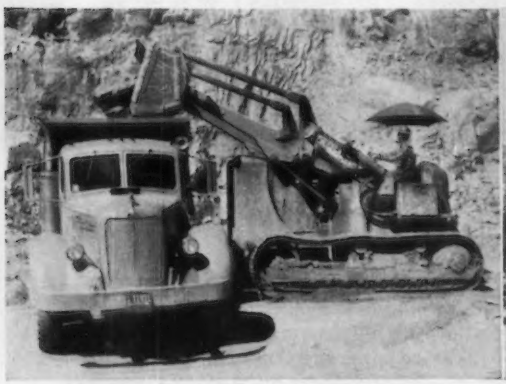


*Special-purpose buckets available up to 7¼ yd.

Walk to work—This Allis-Chalmers HD-21G makes its own way to rugged, inaccessible working areas . . . can "walk to work" where most units with 4-yd capacity would have to be brought in piecemeal.

. . . move ahead with ALLIS-CHALMERS

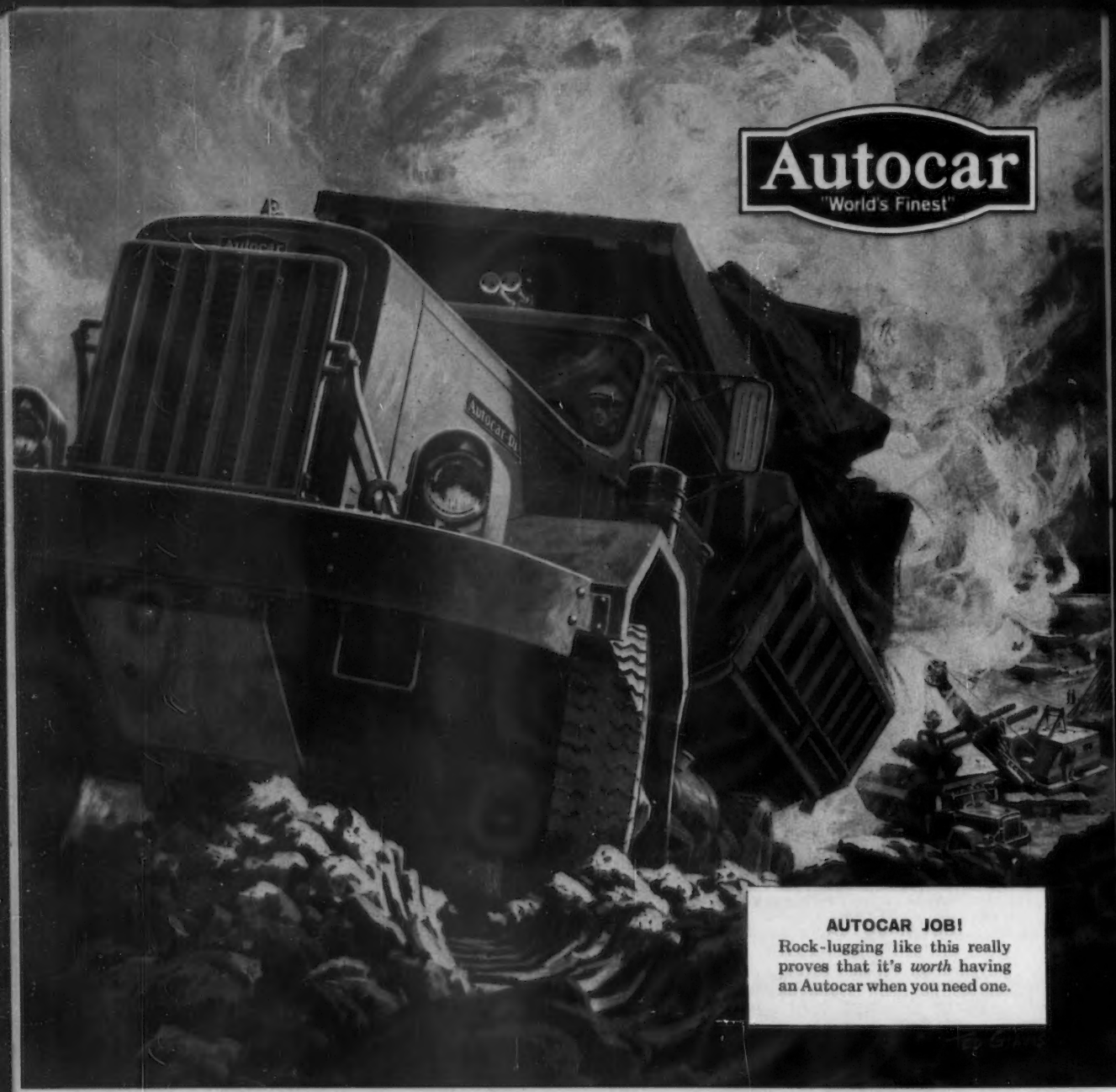
Big Allis-Chalmers tractor shovels are built to handle rock this size with ease and durability. Watch one work—or ask the man who owns one about the *capacity, versatility,* and *easy transport* they offer . . . *three* of the most desirable profit characteristics you'll ever find in *any one machine!*



One-machine fleet — This HD-16G handles a wide variety of pit and quarry jobs . . . not only loading big trucks with ease . . . but clearing new areas, cutting access roads, stockpiling and cleanup as well.

No problem loading—Moving from job to job quickly with the HD-21G and HD-16G adds even more value to these two heavy-duty tractor shovels.

A-C . . . . . power for a growing world



AUTOCAR JOB!
Rock-lugging like this really proves that it's *worth* having an Autocar when you need one.

"This is a job for an Autocar . . . nothing less"

There's nothing like rock-lugging to test the real value of a truck. And there's nothing that meets the test like an Autocar . . . on any pit floor, any haul route, any grade.

Autocar six-wheelers have the stamina to take the shock of big shovel loading—the strength to handle big tonnage—the power and maneuverability to get in and out fast—the heart to go on and on.

Why? Because every Autocar is custom-engineered—with every component chosen to make a balanced unit specifically designed for the job demanded. This means more tons per trip, more trips per hour. It explains why Autocars are first choice in mine and quarry operations.

Why settle for less than the "world's finest"?

Autocar
"World's Finest"

Division of
The White Motor Company
Exton, Pa.

A longer-lasting REVERSIBLE cap and adapter...

Try this on-for SAVINGS!

Service-proved WEARPACT Cap Type Tooth —with foolproof retainer—cuts digging costs to record lows . . . even in taconite!

Probably by now you've heard of Wearpact Steel—the alloy with a combination of hardness and toughness not available in any other commonly used alloy.

Here's a new tooth and adapter design* cast in longer-wearing Wearpact . . . the ASF Cap Type Tooth and adapter that's reversible for longer life. Note that the tooth itself is self-sharpening. Keeps on *slicing* through the ore and overburden—and when finally worn, there's less metal to throw away. *The tooth locks securely to the adapter.* No ASF retainer has ever failed in service.

As for service life, the cost-per-ton figures in large mines speak for themselves. Lowest of any tooth on record! Give this dollar-saving tooth a try! Write today to arrange for an installation.

Cut your costs with WEARPACT

CAST ALLOY STEEL

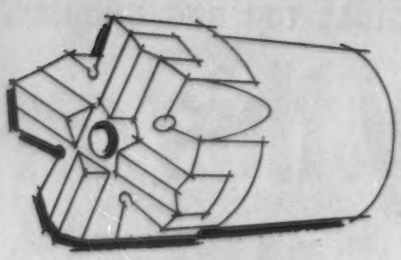
A PRODUCT OF

AMERICAN STEEL FOUNDRIES

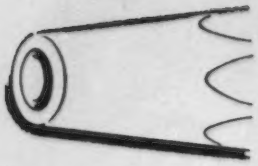
3700 Canal St., Indiana Harbor, Indiana

In Canada: International Equipment Company, Ltd.
Montreal 1, Quebec

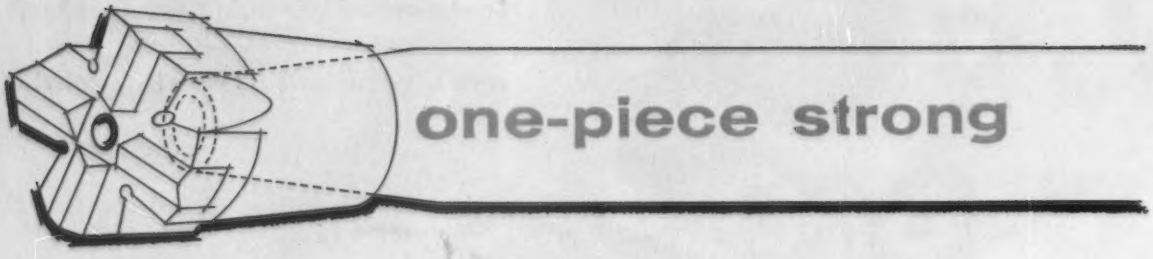
*Patent Pending.



Removable



yet



one-piece strong

Timken air-leg bit cuts your drilling costs 5 ways!

IT'S *removable* to save time and money—yet the new Timken® tapered socket bit for air leg drills has *one-piece strength.* The union is tapered! Now, for the first time, you can get the strength of one-piece bits plus these five cost-cutting advantages of removability that intraset steels can't give you:

1. No need to throw away good drill steel when the carbides wear out. With intrasets you have to waste perfectly good steels.

2. A pocketful of bits is enough for a day's work. You haul an armful of steel with intrasets.

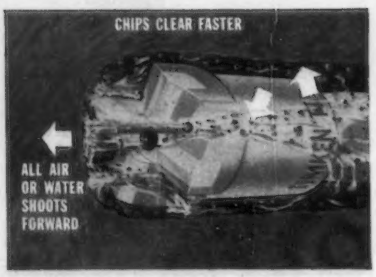
3. You can change bit gauge sizes fast on the same steel. Using intrasets you have to change the whole steel.

4. You carry only the bit to the shop for resharpening. With intrasets you lug the whole steel.

5. You get longer gauge wear because there are *four* carbide cutting edges. Most intrasets have only two.

Notice at right how the Timken Company-pioneered five front hole design clears chips faster. Special analysis carbide inserts resist wear and shock better, can be reconditioned many times. And the bit bodies withstand fatigue because they're made of Timken fine alloy steel.

Get *all* these savings. Switch to the "TTB". For free brochure write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.



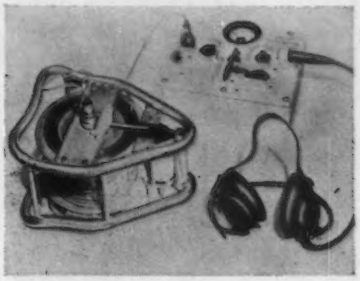
CHIPS CLEAR FASTER because 1) five front holes shoot water or air directly against the rock face and 2) deeper, wider wing clearance lets chips wash back faster.

TIMKEN® **REMOVABLE ROCK BITS**

NEW PRODUCTS DIGEST

In this issue—an electronic ear from England that picks up the sound of a dropped miner's pick at 440 yd, a Lectronic Sentry from the U.S. that cuts mine power to any machine or cable immediately upon sign of dangerous conditions, a Swedish electromagnetic prospecting rig, a new tractor and several large earthmovers, several feeders, a gyratory crusher and a fluid energy mill, and many other new products and choice literature notices for your examination. Reader reply card is opposite p. 46.

DEVICE can pick up signals through solid rock at 700 yards in a quiet mine.



A MICROPHONE and a sensitive amplifier enable the faint sounds to be heard.

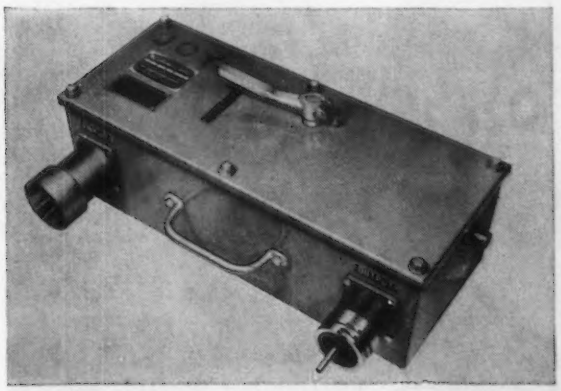
ENCLOSED in its own carrying case, the electronic ear is sturdy and compact.

Electronic Ear Hears Distress Signals Through Solid Rock (1)

AN ELECTRONIC EAR has been invented by a team of British scientists to locate trapped miners. General Electric Co. of England has produced a listening device which enables the traditional distress tapping signals made with a miner's pick to be heard through a barrier of solid or fallen rock. Signals can be picked up easily at 700 yd in a quiet mine and at 440 yd in one where machinery is working and creating noise.

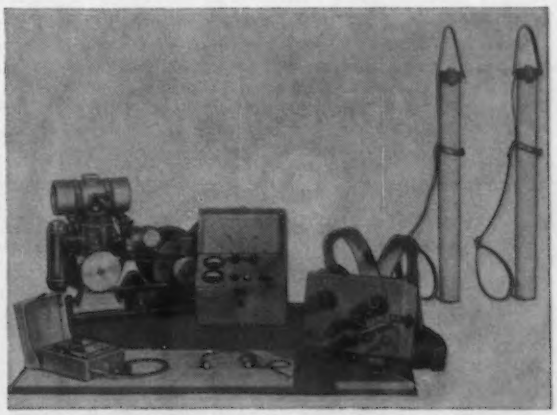
Basically, the underground listening device is a microphone and a sensitive amplifier enabling faint sounds to be picked up. Research work carried out in two British mines shows that the characteristics of the tapping signals vary a great deal from one place to another. Sometimes the sounds carry farthest when low-pitched; other times, the strongest sounds are made at high pitch. The apparatus has been modified to take advantage of this feature—three ranges of sound frequency pick-up are provided on the equipment.

Trapped miners need not have any special equipment with them, other than their work tools. The equipment is safe to use in gassy mines, is built for wear and tear use in hot, moist or wet mines, and when enclosed in its own travel case, can be totally immersed in water without damage.



Lectronic Sentry Protects Against Ground Fault (2)

POSITIVE protection against ground faults and short circuits on any dc off-track mining machines and their trailing cables is now possible, according to Joy Mfg. Co., with their Lectronic Sentry. The two-part unit consists of a transmitting and a receiving element. Whenever the continuous monitoring signal of the sender unit, attached to the mining machine, is interrupted, the receiver (above) at the outby end of the trailing cable, acts instantly to remove power from the trouble-causing machine or cable. Receiver will act whether the dangerous condition is a ground fault or a short circuit in the machine or in the cable. The Sentry can distinguish between a normal overload and a potentially dangerous condition.



Swedish Firm Has New Electromagnetometer (3)

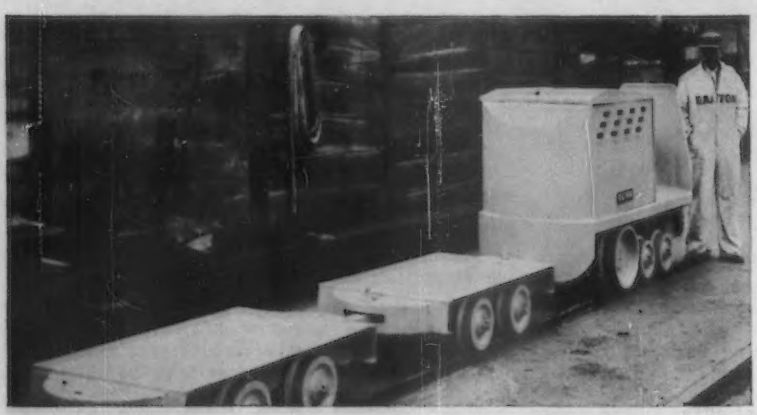
THE TURAM 2S is the latest step forward in the development of the Turam exploration method which got it's start in mining in 1932 when AB Elektrisk Malmletning introduced the electromagnetic inductive method. Results, flexibility, reliability and cost advantages are cited in literature available. Deep-seated orebodies can be found. In the Turam method, the primary alternating field is created by a current passed through a straight grounded conductor laid on the ground parallel to the expected strike of the orebody. Measurements are made along observation grids at right angles to this induced current to locate orebodies and to indicate strike direction.

LeTourneau-Westinghouse Speedpull With 20 Yard Capacity (5)

A FAST, high-production six-wheel self-propelled scraper has been introduced by Letourneau-Westinghouse Co. and named the Model C Speedpull—a machine that teams a 20-cubic yd (heaped) Fullpak bowl scraper with a 276-hp four-wheel prime mover. LeTourneau-Westinghouse is upgrading the entire L-W line of earthmovers; only recently the company showed the Haulpak truck. Like the Haulpak, the Speedpull offers air suspension on the front wheels using the Hydrair principle (nitrogen and oil). There is no front axle on the Speedpull. Pilot models have been in the field since 1957.

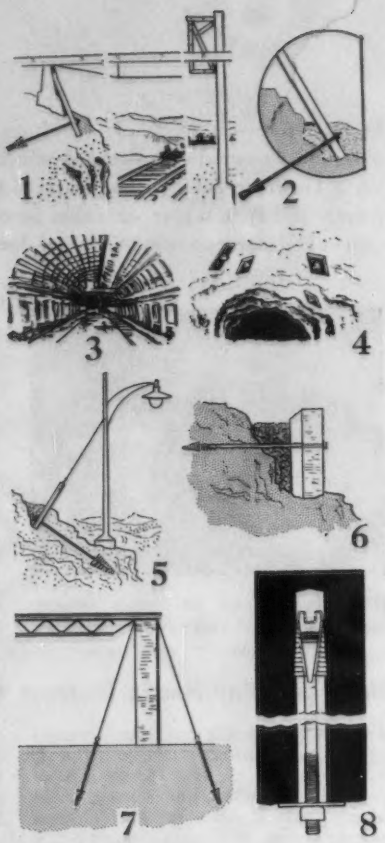
Athey T-Line Trailers Features Extensive Use of T-1 Steel (6)

CHIEF advantage of T-1 steel is its exceptional resistance, even at minus 50 deg F, to the type of punishment and abrasion met in the earthmoving field. That was sufficient reason for Athey Products Corp. to make extensive use of the commodity in their PR619 25-ton rear dump trailer. PR619 is designed to team with a Caterpillar 619 tractor. The PR619 hauls up to 20-cubic yd (heaped) on a 2:1 slope. It has a road speed tops of 30.2 mph.



Miniature Battery Train Used in Copper Refinery (8)

EASTON CAR & CONSTRUCTION CO., best known for some very large earthmovers has come up with one of the smallest for a special job. It consists of a railed tractor driven by storage batteries and two 4 ton cars on 24-gage track.

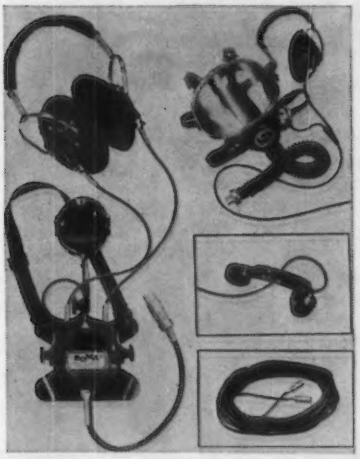


Versatile Roof Bolts (9)

SOME TYPICAL non-mine applications for mine roof bolts, as reported by Republic Steel Corp., include: (1) and (2), anchorage for a trestle carrying drain pipe over railroad tracks. Drawing at right shows the anchorage in detail, holding a pipe strut at right angles; the mass around the nut on the mine roof bolt is concrete, and the main body of the bolt pierces the rock by way of a pre-drilled hole; (3) and (4), water or drain tunnel drilled through a mountain, showing, at left, the maze of wooden shoring required for conventional construction; at right, interior of the tunnel when simply but safely supported, prior to concrete pouring, by mine roof bolts; (5) bolt serving as anchorage for a guide wire which helps to brace a street light or flood light in rocky terrain; (6) roof bolt serving as an anchorage for a building wall erected next to a rocky outcropping; (7) mine roof bolts, one on each side, serving as anchorages for guy wires giving extra support to a foundation wall threatened by flood or high wind; (8) cross section of the mine roof bolt's extreme ends, showing, at the top: the wedge-shaped gripping device which enables the bolt to fasten itself into rock or concrete with increasing firmness as pull on the bolt is increased. The threaded exposed end of the bolt, in the bottom of this drawing, makes it possible to pull the bolt's supported end more tightly into the wedge-shaped device, thereby assuring a tight grip.

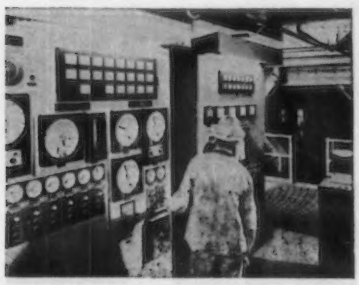
Crawler Tractor (10)

INTERNATIONAL HARVESTER Co's Drott 4-in-1 Skid-Shovel is shown above mounted on a T-340 crawler recently introduced by the company. Segmented-type bucket has ⅝-cubic yd struck capacity, can be used as a standard bucket, bulldozer, carry-type scraper and clamshell. Unit is powered by four-cylinder gasoline engine with 135-cubic in. displacement and 31-drawbar hp.



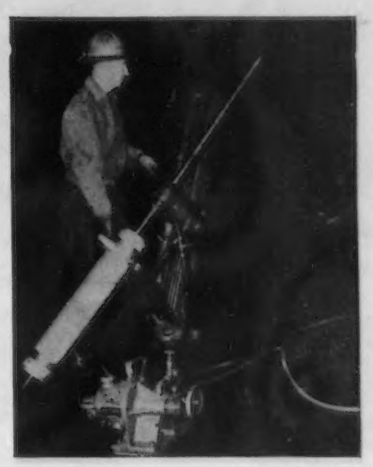
Sound Power Phones (11)

SOUND-POWERED microphone is permanently installed in the face piece of a Scott Air-Pak rescue unit. Reliable high fidelity communications that are dependable—your own voice supplies the power to communicate with the outside—no batteries or power cable to drag along. Boma Corp. calls the phone the 3-D Sound Powered System.



Grinding Mill Control (22)

ELECTRIC load controls are used at Louisville Cement Co. to maintain optimum grinding rates in their ball mills. In one month after installation of the Leeds & Northrup Co. recorders and recorder-controllers, the cement maker reports that grinding mill output had increased by 75 barrels a day. The electrical load on the motors operating the mill discharge elevators is measured and used to control the unit's production.



Air Powered Packsack (12)

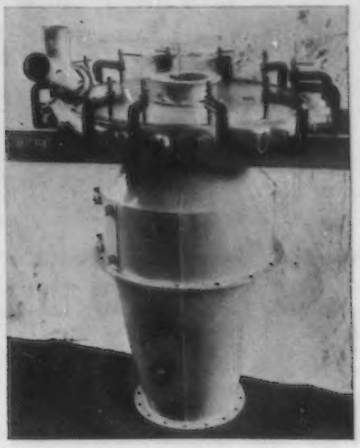
LIGHTWEIGHT, completely portable, the Packsack drill is now offered air-powered for use where there is compressed air. Acker Drill Co., Inc., suggests low diamond cost, reduced operating water requirements and detachable air jack leg as some of the advantages for this diamond core drill. Bit size is 1¼ in.

Ear Protector (13)

LIGHTWEIGHT, sanitary and inexpensive ear protector offering optimum noise protection has been developed by RCA and is being distributed by Bausch & Lomb Optical Co. Called Quiet-Ear, the device is easily adjustable.

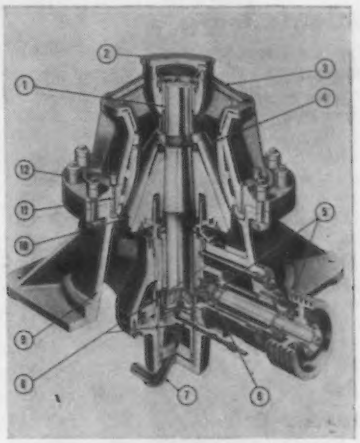
Joy's Mexican Subsidiary (15)

FACILITIES for manufacturing Joy-Truco diamond bits are in operation at Colonia Nueva Industrial Vallejo, Mexico City, D. F. where Joy Mfg. Co.'s wholly-owned subsidiary Joy Sullivan Machinery Co., S. A. de C. V. operates the plant and service shop and warehouse. The plant is equipped to produce and service high quality diamond bits in accordance with the latest technology developed by Wheel Trueing Tool Co.



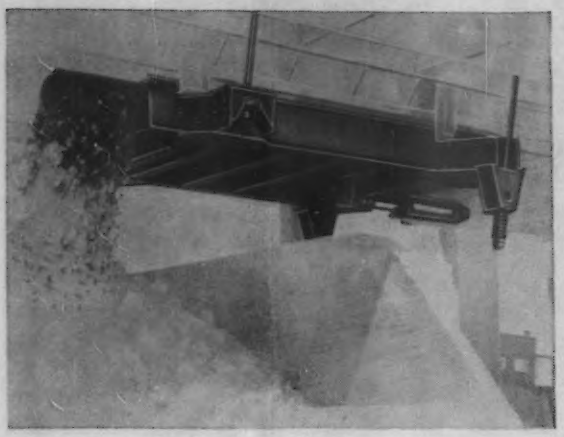
Large Fluid Energy Mill (20)

THE LARGEST fluid energy mill ever manufactured according to Sturtevant Mill Co.—a 42-in. dia Micronizer—has been constructed recently at the company's Dorchester, Mass. plant. Giant mill has 50% greater capacity than a 36-in. mill, is capable of grinding from 750 lb to over three tons per hour. In May, Sturtevant announced that a fluid energy mill had been created that would grind abrasives. The abrasives mill has a tungsten carbide liner.



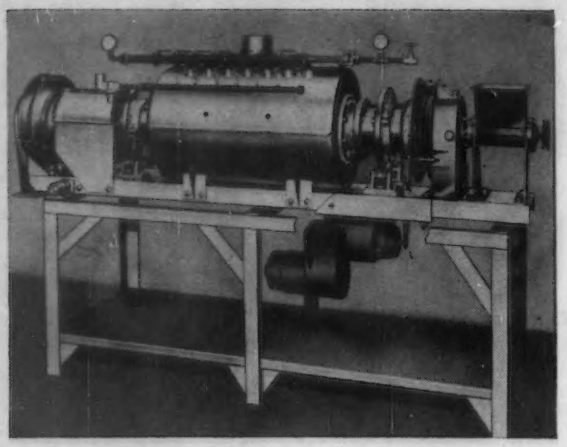
Hydrocone Crusher (21)

A HYDROCONE crusher that produces less fines, has greater output, with reduced wear, maintenance and space requirements has been introduced by Allis-Chalmers Mfg. Co. Unit is a 36-in. crusher with A-C's Hydroset control and is available in feed openings of 7-, 4- and 2-in. size. Model 736 is for coarse crushing, the 436 for medium and the 236 for fine crushing.



Versatile Feeder Uses Hydraulic Power (35)

OPERATION under rugged mining conditions in many parts of the continent has placed the stamp of approval on the Hydrastroke feeder according to National Iron Co. Hydrastrokes are being used to feed belts, load trucks, skips and railroad cars, and feed screens and crushers. The feeder drive is a hydraulic cylinder connected to the feeder and an adjacent support member to reciprocate the deck. The hydraulic pump can be either fixed or variable volume type. Low first costs, ability to take shock loadings, are some of the advantages cited.

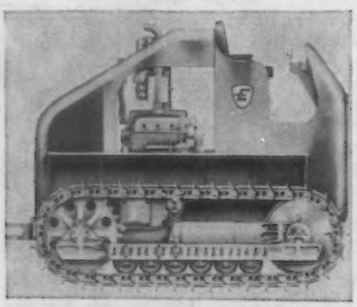


Experimental Calciner Heats to 2000 deg F (38)

THE EXPERIMENTAL research size continuous rotary combination calciner and cooler built by C. O. Bartlett & Snow Co. is ideally suited for continuous heating to about 2,000 deg F or cooling to the range of 150 to 200 deg F. Units are available in two sizes, approximately 42 in. wide by 4 ft high by 107 in. long when fitted with a 7-ft retort tube (or 170 in. long when fitted with a 134½-in. retort). Both types can be fuel fired or electrically heated.

Vibrating Feeder (29)

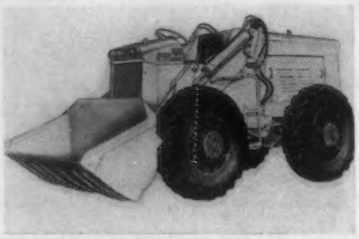
THE CARRIER Amplitrol feeder, a mechanical vibrating unit with an exclusive pneumatic control system, is available from Carrier Conveyor Corp. Fully variable, stepless amplitude control and Carrier's exclusive Natural-Frequency drive are two features of the device. The drive unit is composed of a 900-rpm, ac motor-exciter mounted between two banks of heavy-duty air springs which provide the drive energy. The motor size is governed by the size of the drive trough and in standard models is only ½ hp for troughs up to 2x8 ft. Largest standard Amplitrol feeder available is 5x8 ft (3hp).



Crawler Tractor (4)

THE 103 SERIES tractor, developed by Eimco Corp. as a companion to the larger and heavier 105, features parts molded to scientifically established stresses and shapes and cast in electric steel. The entire track frame and diagonal brace is one piece. The final drive, center housing and main frame are one piece, without bolts or welds. Castings can be welded if needed, and all parts are readily accessible. Torque converter and Eimco's Unidrive team up to give four speeds in either direction backed up by 100hp.

has gas-turbine 300-kw generator sets powered by the 500-hp Jupiter engine in use in isolated locations.



Wheeled Loader (16)

THE NEW MODEL TL-16 TractoLoader announced by Allis-Chalmers Mfg. Co. weighs 16,000 lb, but can lift 7,000. It is available for use with any of five bucket sizes from ½- to 4-cubic yd. Manufacturer suggests that the weight of the material to be carried be calculated before determining bucket size—the heavier the material, the smaller the bucket that should be used.

Alumina Refractory (27)

AN ALUMINA refractory, Pitco 80 (it contains 80% alumina) combining all the advantages of a monolithic construction, formerly available only in castables and ramming mixes, with the advantage of plastic construction has been developed by H. K. Porter Company, Inc. Advantages cited—air and gas tight, no special shapes needed, high thermal shock resistance, withstands heavy loads and temperature variations and long service. Pitco 80 will withstand temperatures to 3,200 deg F.

Gas Turbine Engines (7)

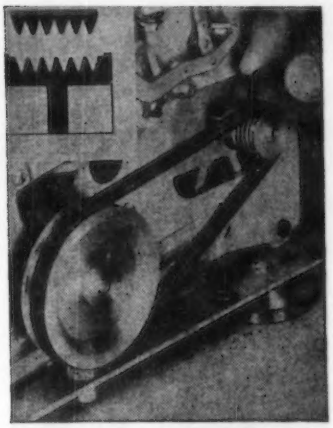
A GAS turbine weighing only 950 lb that develops 1,250 hp was shown by Solar Aircraft Co. at the recent International Petroleum Exposition. Specific fuel consumption is only 0.6/hp/hr and a thermal efficiency of 23% is claimed —both outstanding advances in turbine engine technology according to Solar. The Saturn engine (like its smaller Jupiter, Mars, and Titan cousins) will serve as power source for generator sets, boat, ship and propulsion units, compressor and pump drives. Solar also

Packaged Lube System (26)

A COMPLETE, packaged lubricating unit with built-in safety features has been announced by Nordberg Mfg. Co. Protecto-Lube System, primarily designed for the Symons crusher, can be adapted to other crushing and processing equipment. Lubricant is under constant, controlled pressure and temperature and is filtered before being returned to the oil circulating system. Unit is available in three sizes—10-, 25- and 50-gpm output with operating ranges of 20% above and below this figure.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.



POLY-V drive "J" for small diameter sheaves and short centers are the newest drive for small machinery. They are quiet running, vibration free and space savers according to Raybestos-Manhattan, Inc. 4pp. **(63)**

SPEED VARIATOR—a mechanical traction type employing ball bearings and having stepless speed control—is illustrated in Cleveland Worm & Gear Co.'s eight-page bulletin (K-250). **(64)**

FULLY submerged electric pumps—the Flygt B-80L with capacity of 300 gpm against a 25 ft head, or 70 gpm at 150—weighs only 175 lb according to four-page bulletin from Stenberg Manufacturing Corp. **(65)**

NICKEL CADMIUM storage battery for switchgear control and emergency power with pocket plate construction are illustrated in a six-page bulletin (AG 250-7) from Nife Inc. **(67)**

HAND and cap lamps in the Nife Inc. line are illustrated in a six-page bulletin (6. 51. 3,500). **(68)**

NICKEL CADMIUM storage battery for railroad signal services are presented in Nife Inc.'s four-page bulletin (110). **(69)**

HEAT EXCHANGER catalog from Wolverine Tube Div., Calumet & Hecla, Inc. discusses design and cost comparison of heat exchangers using Wolverine Trufin, the integral finned tube. 19pp. (6659-23). **(70)**

CONVEYOR BELTING for mining catalog (122) from U.S. Rubber Co. discusses types of construction, belts for coal, metallics and nonmetallics, and splicing services. 8pp. **(71)**

COMPLETE details and illustrations of air, spray and welding hose fittings for industrial rubber hose applications are contained in a four-page bulletin (198) from Hose Accessories Co. **(73)**

MARINE fendering for docks and ships from US. Rubber Co. are presented in a 20-page illustrated catalog (831). **(74)**

TROYFELT, what it is, how it's made, and what it can do in filtering oil, gas, air or mineral pulps is discussed in Troy Blanket Mills' eight-page brochure. **(75)**

VOLTAGE regulators catalog from General Electric Co. (GEC-1450A) details the Inductrol line for uses such as rectifiers, induction heating, variable speed drives, electrostatic precipitators and regulated load centers. 58pp. **(76)**

NU-FLOR can withstand heaviest loads without chipping or cracking. It is quiet, clean, sanitary and odorless and can be used indoors over-concrete, wood or metal, new or old, according to a brochure from Monroe Co. **(77)**

SLIDING GATE diaphragm control valves for steam, water, oil, gas and chemicals are illustrated in OPW-Jordan bulletin (J-170). **(78)**

POWER transmission machinery in the Dodge Mfg. Corp. line is presented briefly, but comprehensively, in an eight-page bulletin (A-706). **(79)**

PLACE REQUIRED POSTAGE HERE

McGRAW-HILL PUBLISHING COMPANY, INC.
ENGINEERING & MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 36, N. Y.

E&MJ NOT GOOD AFTER FEB. 1, 1960 **AUG. 19**

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	11	21	31	41	51
2	12	22	32	42	52
3	13	23	33	43	53
4	14	24	34	44	54
5	15	25	35	45	55
6	16	26	36	46	56
7	17	27	37	47	57
8	18	28	38	48	58
9	19	29	39	49	59
10	20	30	40	50	60

61	65	69	73	77	81	85	89	93
62	66	70	74	78	82	86	90	94
63	67	71	75	79	83	87	91	95
64	68	72	76	80	84	88	92	96

Name .....

Title .....

Company .....

Address .....

☐ Enter my one-year subscription to *E&MJ* and
(U.S., $4; Canada, $5; Latin America and Phili
$8; elsewhere, $15).

E&MJ NEW PRODUCTS DIGEST (*Continued*)

COMPRESSED air line cleaner developed by Logan Engineering Co. is described in an eight-page bulletin. The Aridifier will remove 92% or more of the oil, moisture and fine scale and dirt from compressed air lines. **(80)**

AIR STARTING motors are detailed thoroughly in Ingersoll-Rand Co.'s 24-page bulletin on sizes 2BM and 10BM—as well as prior sizes 5BM and 20BM. Also contains a nine-page section on size and model number of air starter for most diesel, gasoline, natural gas or dual-fuel engines of 29 leading manufacturers. (509E). **(81)**

DECO TREFOIL for March-April, 1959 contains a design study on a compact solvent extraction mixer-settler designed by H. L. Hazen, consulting engineer, and a simple way to alter the position of riffles on a lab table. Denver Equipment Co.'s feature article is the Manvers, England coal preparation plant. **(82)**

PIPE WELDING booklet prepared by Air Reduction Sales Co. contains two technical articles on small pipe welding reprinted from AIR CONDITIONING, HEATING & VENTILATION (ADR-118). 9pp. **(83)**

FULL information on Vycor brand 96% silica glass which withstands high temperatures and drastic thermal shock is given in an eight-page bulletin prepared by Corning Glass Works. (B-91). **(84)**

STEAM specialties manufactured by Illinois Engineering Div., American Air Filter Co., Inc. are described in a 12-page product bulletin (203) showing valves, thermostatic traps, floats, steam traps and pipe line strainers. **(85)**

LOW HEADROOM heavy duty electric hoists in the Northern Engineering Works line are presented in a 12-page catalog. **(86)**

MOTORLESS Vibro-Pneumatic industrial cleaner comes in three models—Pick-a-back, Castered tank, and Recovery model—according to literature available from Vibro-Pneumatic Cleaner Co. **(87)**

INDUSTRIAL hose and fittings from Aeroquip Corp. are presented in an illustrated 12-page bulletin (612). **(88)**

FEED WATER control system for industrial boilers is the subject of an eight-page bulletin (530) from Bailey Meter Co. **(89)**

COAL preparation manual No. 559 from McNally Pittsburg is pocket size and contains 129 pages of essential engineering data on all McNally Pittsburg equipment. **(90)**

MURIATIC ACID reference manual, covering history, properties, applications, reactions and Dow Chemical Co.'s experience and interest in the product is available from Dow. 44pp. **(91)**

MURIATIC ACID brochure prepared by Stauffer Chemical Co. is composed of 10 sections, outlining the uses, instructions for mixing, diluting and handling, analytical procedures. 40pp. **(92)**

STYROFOAM pipe and vessel insulation is described in 11-page bulletin (37-B) made available by Dow Chemical Co. **(93)**

ARMCO FOUNDATION products catalog describes three basic types of Armco Drainage & Metal Products, Inc. pipe piles, caissons and Hel-Cor pile shells. 16pp. **(94)**

BENDIX COMPUTER has literature available on G-15, their general purpose digital computer with a new simplified programming system that makes the G-15 simple to operate with only four hours of instruction. **(95)**

GENERAL PRECISION Equipment Corp. has literature on their computerized process control system and what it can do for your flowsheet. **(96)**

DATICS CORP. shows how they engineered a pipeline network with a computer. **(97)**

REMINGTON RAND UNIVAC has a new coding shorthand program called Math-Matic which greatly simplifies programming of the "Monster of the Morons," Univac. **(98)**

CONTROL SYSTEMS CO. has developed Telecontrol, a system that communicates, gathers data and controls the process. **(99)**

Item For Sale

COMPUTERS, a *Business Week* 10-page special report is available. 330 West 42nd St., New York 36, N.Y. Price 50c.

E&MJ NOT GOOD AFTER FEB. 1, 1960 **AUG. 1959**

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

11	21	31	41	51
12	22	32	42	52
13	23	33	43	53
14	24	34	44	54
15	25	35	45	55
16	26	36	46	56
17	27	37	47	57
18	28	38	48	58
19	29	39	49	59
20	30	40	50	60

61	65	69	73	77	81	85	89	93	97
62	66	70	74	78	82	86	90	94	98
63	67	71	75	79	83	87	91	95	99
64	68	72	76	80	84	88	92	96	100

Name .....

Title .....

Company .....

Address .....

☐ Enter my one-year subscription to *E&MJ* and bill me (U.S., $4; Canada, $5; Latin America and Philippines, $8; elsewhere, $15). No. 2

PLACE REQUIRED POSTAGE HERE

McGRAW-HILL PUBLISHING COMPANY, INC.
ENGINEERING & MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 36, N. Y.

A thunderstorm three miles away

has been known to detonate a blast prematurely

For best protection against stray electric currents

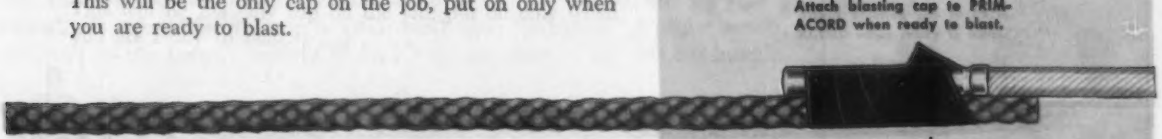
You need not worry about stray electrical currents when you can hook-up and detonate with Primacord! It acts as the detonating agent throughout the entire column of explosives, or furnishes initiation to primers. This use of Primacord will result in safer, easier, quicker loading. Primacord also connects all holes, providing positive initiation, with results that you should find profitable.

When your blast is loaded and hooked up, it cannot be set off by normal vibration or friction, ordinary impact or sparks, *or stray electrical currents.* Even a direct hit by lightning failed to detonate Primacord. It must be detonated with fuse and cap or electrical blasting cap. This will be the only cap on the job, put on only when you are ready to blast.

ENSIGN-BICKFORD

PRIMACORD®

DETONATING FUSE


Attach blasting cap to PRIMACORD when ready to blast.
Use fuse and cap wherever stray currents are suspected.
Prime and hook-up all holes with PRIMACORD.

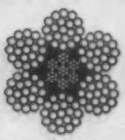
The trunk line illustrated is Lo-Temp® Primacord. For further information see your explosives supplier or write to

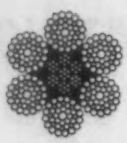
THE ENSIGN-BICKFORD COMPANY

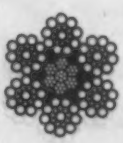
Simsbury, Connecticut • Since 1836

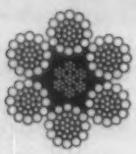
YOU CAN'T BARGAIN WITH SAFETY

WICKWIRE ROPES FOR THE MINING INDUSTRY


6 x 25 Filler Wire, IWRC


6 x 41 Filler Wire, IWRC


6 x 19 Seale, IWRC


6 x 31 Seale, IWRC

For detailed recommendations, write the nearest CF&I sales office and ask for WR 737.

For safety and performance

. . . order **CF&I-WICKWIRE**

"job-designed" wire ropes

The Image of CF&I—a giant steelman—stands for the rigid quality-controls and testing procedures that are carried out in the production of Wickwire Rope. This Image also reflects CF&I's ability to design a specific product to meet a particular need.

These are the very reasons why CF&I-Wickwire Ropes are both *safe*—as only a *quality* wire rope can be—and *suitable*—because they are available in a *complete range* of wire grades, types, sizes and constructions, designed to meet each industry's requirements.

Avoid the losses—due to injuries and wrecked equipment—that can occur when a "bargain" rope fails. Buy a quality wire rope that's designed for the job it must do—a CF&I-Wickwire Rope.

WICKWIRE ROPE

THE COLORADO FUEL AND IRON CORPORATION

CF&I STEEL

In the West: **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque • Amarillo • Billings • Boise • Butte • Denver El Paso • Farmington (N. M.) • Ft. Worth • Houston • Kansas City • Lincoln • Los Angeles • Oakland • Odessa (Tex.) Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Tulsa • Wichita

In the East: **WICKWIRE SPENCER STEEL DIVISION**—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) New Orleans • New York • Philadelphia

6794-B

engine power
BY CATERPILLAR

Why White Canyon Mining Co. chose a Cat Engine for a remote uranium mine

"Dependability" was the big factor in favor of this Caterpillar D342 when White Canyon specified engine power for their uranium mine. This engine has performed well for over two years at the No. 1 Mine.

White Canyon Mine No. 1, located 54 miles west of Blanding, Utah, relies on a Cat D342 . . . the same as their Hide Out Mine on Deer Flat. Why? . . . because these remote mines cannot "baby" their power source, they must have dependability.

Foreman Lester J. Hancock says, "When we consider equipment we must have dependability as well as operating and maintenance economy. In the faraway places we must have engines that will run and get the work done."

White Canyon No. 1 is a drift mine, the main tunnel being 750 feet long. Loading at the faces is accomplished by a Caterpillar No. 933 Traxcavator, ore is removed by truck.

Cat Engines are good for underground or tunnel work because of their complete combustion system, clean exhaust, and relatively low ventilation requirements. More and more mines and tunnel jobs specify Cat Engines in locomotives, shuttle cars and loaders for these reasons. Ask for Cat Diesel power for aboveground or underground applications, whether you need electric sets or other mining machinery. Most all quality-conscious equipment manufacturers offer Cat power. For a listing of manufacturers' machines powered by Cat Diesels, send for Form No. 20153.

CATERPILLAR

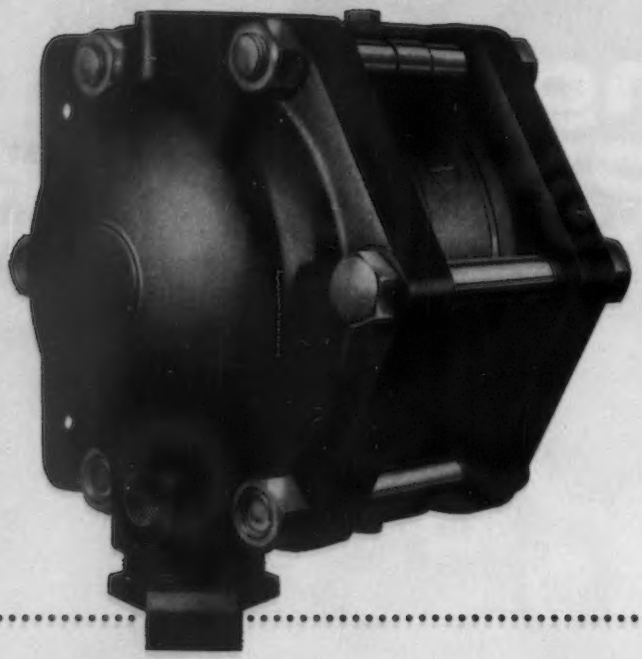
Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

White Canyon No. 1 produces 75 tons a day from flat drifts extending into this hillside.

Caterpillar Diesels with suitable exhaust conditioners help make the Traxcavator a popular underground machine.

Foreman Hancock here shows .28 uranite with small copper content from White Canyon No. 1 Mine.



No other flow meter gives you the accuracy, convenience and economy of the new Honeywell Bellows Flow Meter

- **Calibrated accuracy ± 0.5% of full scale**
- **Leakproof between liquid fill and process fluid**
- **No mercury to contaminate process fluid**
- **No zero shift between —40 and +250°F**
- **Fast range changing in field; choice of fifteen ranges**
- **High corrosion resistance**
- **Fast, accurate damping adjustment**
- **Meter body is self-venting, draining or purging**

Here's the most advanced meter body available today for flow and liquid level metering. You can use it with virtually any process fluid, with combustible fluids, and in hazardous atmospheres. Meter body has connections for either vertical or horizontal piping. Remove it from the system for servicing without disturbing the piping.

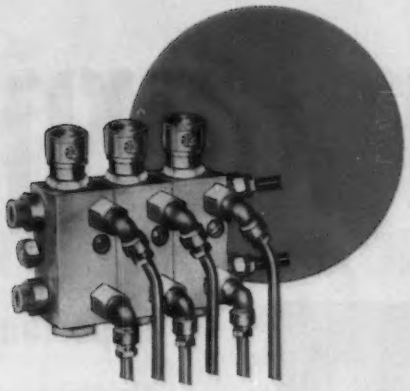
Models available in many ranges, for both flow and liquid level measurement and control. Call your nearby Honeywell field engineer for details on the new Honeywell Bellows Meter. He's as near as your phone. Or write for Catalog C22-1.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

- **Reference Data: Write for Catalog C22-1 "Bellows Flow Meter".**

Honeywell

First in Control



Type II Accumatic Valves are fully automatic. Completely sealed for *clean* lubrication of power shovels, cement kilns, conveyors—any indoor or outdoor installation. For all fluid oils and most lighter greases. Available in four sizes to fit a wide range of applications.

Accumatic®

AUTOMATICALLY LUBRICATES ALL BEARINGS

SAFELY, ACCURATELY, ECONOMICALLY

An Accumatic Centralized Lubrication System delivers measured amounts of lubricants at proper intervals, to provide a better lubricant film on all bearing surfaces. Assures completely accurate lubrication, *even while machine is in operation,* with no interruption in production. Reduces lubricant consumption and prolongs service life of each bearing. Machines with many bearings or dangerously located bearings are lubricated from one central point . . . vital high-precision machines receive proper lubrication at all times.

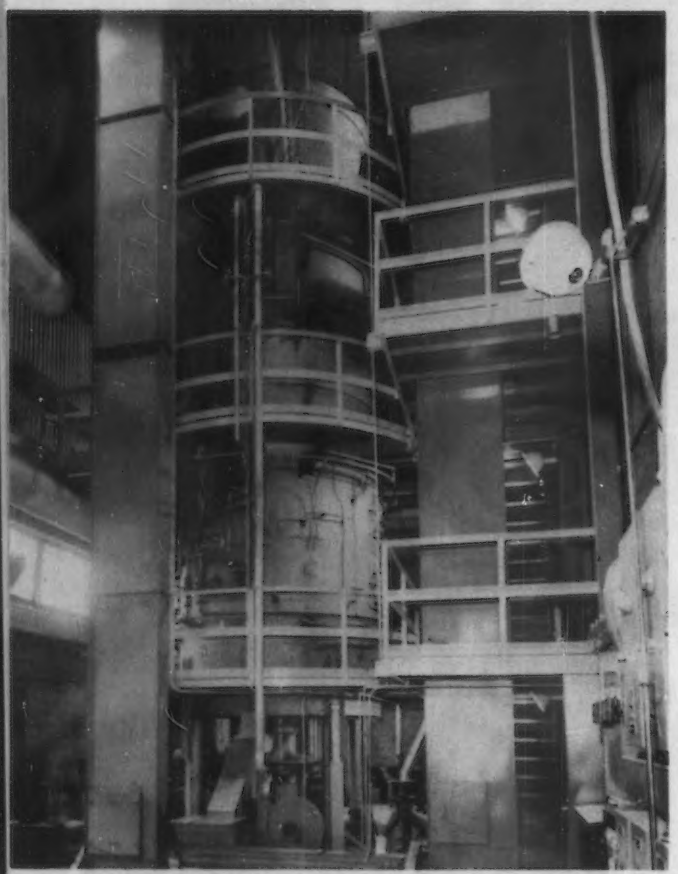
Write for Accumatic catalog today!

Symbol of SW Excellence

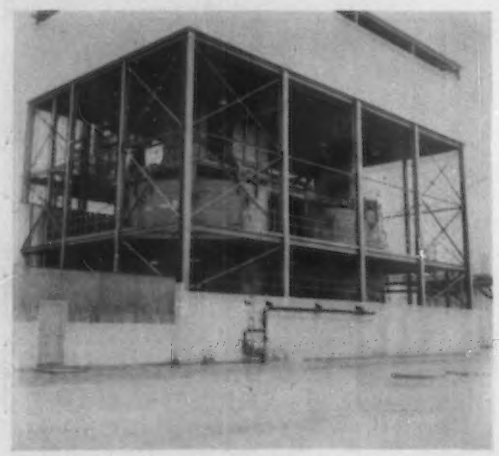
ALEMITE DIVISION
STEWART-WARNER CORPORATION

Dept. M-89, 1850 Diversey Parkway, Chicago 14, Illinois

Skinner Furnaces



8' I.D., 8 Hearth Skinner Furnace roasting molybdenum concentrates.



Two 23'6" I. D., 4 Hearth Skinner Furnaces drying over 40 tons of copper sulphide concentrates per hour.

Important Advantages

Flexibility. A wide range of possible combinations of diameter, number of hearths, number of burners, gas offtakes, up or down draft, rate of feed, retention time, etc., permit engineering a Skinner Furnace to the exact requirements of each individual application.

Minimum Dust Losses.

Will Handle Sticky Material.

Accessibility. All wearing parts may be replaced without cleaning out or cooling down the furnace.

Visibility. Access doors permit view and accessibility of material at each hearth.

Small Space. Minimum floor space per ton capacity.

2 to 14 Hearths.

4'0" to 23'6" Inside Diameter.

22 to 4000 sq. ft. Hearth Area.

Gas, Oil or Coal Fired.

Proved and Improved for 38 years

Licensed Manufacturers and Sales Agents in Canada, Australia, Sweden, England and South Africa.

Sales Agents in Chile, Peru, Philippine Islands, Japan, New York City (for Continental Europe), and in the principal cities of the United States.

...for Drying, Roasting, Calcining, Incinerating and Decomposing

Applications

Roasting Molybdenum Sulphide Concentrates. The Skinner is of particular value here, where critical and very accurate control is essential to produce the desired product.

Roasting Uranium-Vanadium Ores. The Skinner is being widely used on the Colorado Plateau and in foreign countries for salt roasting uranium-vanadium ores at rates as high as 200 tons per day, per machine. Organics are also removed during this process.

Drying Uranium-Oxide Precipitate. The Skinner has been accepted as the standard unit for drying uranium oxide precipitate. Skinners operating in this field are handling from 1000 to 30,000 pounds per day, per machine, on feed containing 50 to 80% moisture. Of particular advantage in this application is the possibility of "up-grading" the product.

Decomposition of Oil Sludge. The advantage of the Skinner in recovering acid from oil sludge has been in its ease of control and higher capacities, compared with other type units.

Lime Burning. In lime burning the Skinner's ease of control and fast slaking product, with maximum CaO product, is of distinct advantage in beet sugar refining.

Drying Copper Concentrates. A relatively recent application is in drying copper concentrates at critical maximum temperatures to control moisture content ahead of smelting operations. Capacities up to 600 tons per day, per machine.

Roasting Zinc Ores. One of the widest applications is for roasting zinc ores. A typical installation reports, after 25 years of continuous service, original refractory still being utilized. Conventional or flash roasting is available.

Manganese Reduction.

Dehydration of Alunite.

Calcining of Basic Alum for production of 99% alumina.

Calcining of lime sludges, clays, foundry sand, carbon, etc.

Incineration of sewage, either as garbage or digested sludge.

Operation and Construction

The Skinner is the multiple hearth type furnace. It consists of a series of refractory hearths superimposed one above the other and separated and supported by a cylindrical refractory wall. This assembly is built upon and supported by a steel framework and shell.

A central, vertical shaft rotates horizontal arms, equipped with rabble teeth, for each hearth. Material is fed to the top hearth. The rabble teeth stir and convey the material to "drop" holes where it falls to the hearth below.

Burners generally operate through openings in the shell, the number of burners and their location are determined to meet the specific requirements of each individual installation.

Manufacturing Division

THE MINE AND SMELTER SUPPLY CO.

DENVER 16
3800 RACE STREET

NEW YORK 17
122 E. 42nd STREET

SALT LAKE CITY 1
121 W. 2nd S.

EL PASO
P. O. BOX 1162

Famous Traylor Gyratory Crushers are manufactured in sizes designed to solve most reducing problems. From the mighty 60" TC to the TF Fine Reduction Crusher—Traylor engineers supply the finest Gyratory obtainable.

Traylor-made gyratory crushers

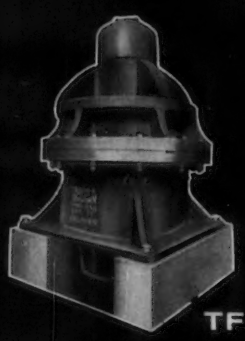
TC Gyratory Crushers are made in 7 sizes with feed openings 20" to 60" and capacities from 1,240 to over 32,000 tons per eight-hour day. For additional information, write for Traylor Bulletin No. 1126.

TY Reduction Crushers are built in 6 sizes from 1'—3" to 5'—6" and with feed openings from 3" to 22". For more information, write for Bulletin No. 8112.

Traylor TF Fine Reduction Crusher produces ⅜" to 1¼" material in large capacities. Over a half century of engineering experience is built into all Traylor crushing machinery. Write for Bulletin No. 127.

TC

TY


TF

Traylor

ENGINEERING & MFG. CO.

1181 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

BALL MILLS

ROTARY KILNS

APRON FEEDERS

PRIMARY GYRATORY CRUSHERS

JAW CRUSHERS

SECONDARY GYRATORY CRUSHERS

Maintaining steady production at Ayrshire Collieries Corp. Harmattan Mine

Stripping 80′ or more of overburden to reach the coal seam is a rugged job at Ayrshire's Harmattan Mine near Danville, Ill. Two Bucyrus-Erie walking draglines with 25 yd. and 30 yd. buckets are handling the job. Both rigs are equipped with Yellow Strand Wire Rope—including 2″ twin hoist lines, right and left lang lay 2½″ drags and 1⅜″ dump lines. At last report, Yellow Strand Wire Rope was giving excellent yardage, and was still going strong.

LONG LIFE . . . LOW OPERATING COST . . . are the reasons for this Yellow Strand preference.

To take advantage of this extra value, call your Yellow Strand Wire Rope distributor today!

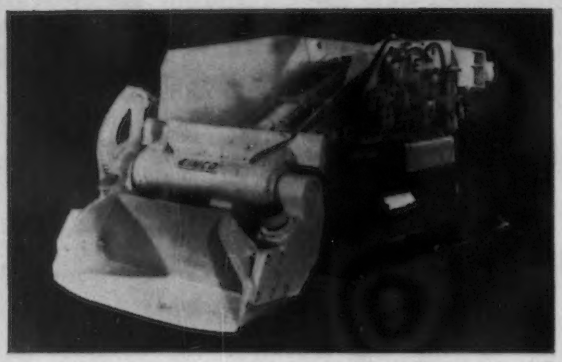
Broderick & Bascom Rope Co., 4203 Union Blvd., St. Louis 15, Mo.

Yellow Strand®

WIRE ROPE SLINGS CLIPS

More Work-Ability!

"OUR EIMCO® 635 CONVEYOR LOADER IS THE FINEST PIECE OF EQUIPMENT WE OWN!"



That's the enthusiastic word from T. W. Newell, Vice - President and manager for Shattuck Denn Company. Operating a five foot low-headroom machine at their Bardon Shaft near Moab, Utah, this progressive mining company is presently driving seven headings. Their efficient Eimco 635 Low Headroom Conveyor Loader handles four per shift, loading into shuttle buggies. Complete time cycle of loading each three to four ton buggy is consistently under two minutes and usually closer to 100 seconds; is capable of handling 100 tons per hour.

Frank Garrett is mine superintendent at this operation, which also uses an Eimco Air Tugger Hoist to pull the drill jumbo to one side when it is hoisted out of the shaft and an Eimco 42" Folding Scraper to load their skip pocket.

You'll find that Eimco has the answer to any underground material handling and loading problem. To get the qualified and personal services of an Eimco sales-engineer, just contact the sales office nearest you or The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah, U.S.A.

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

THE EIMCO CORPORATION

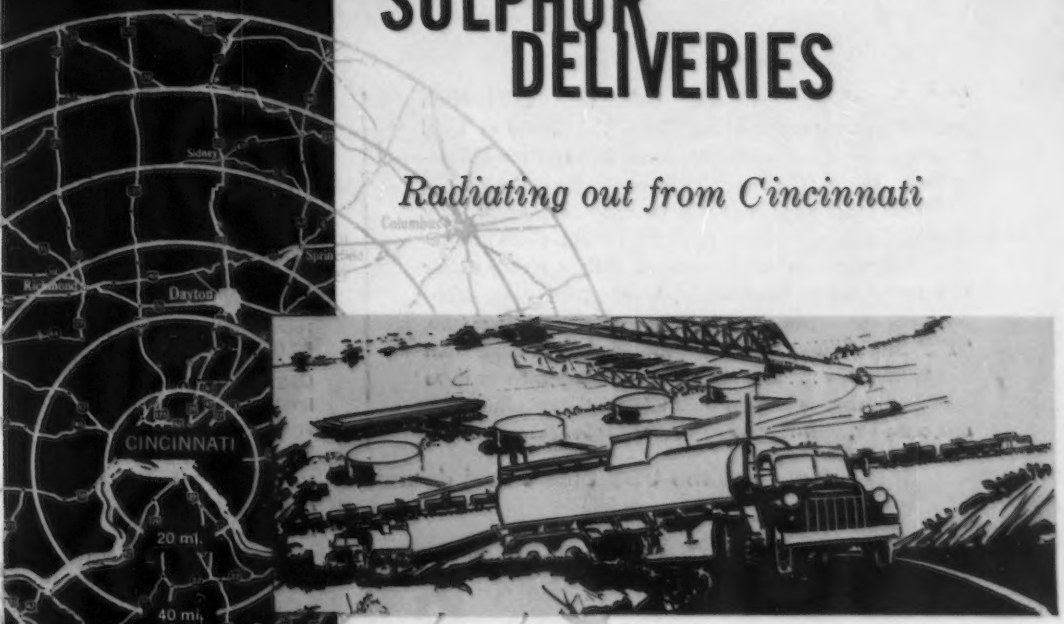
EXPORT OFFICE: 51 - 52 SOUTH STREET, NEW YORK, N. Y.
BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

EIMCO B - 428

MINING EQUIPMENT DIVISION
634 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

NOW.... PROMPT MOLTEN SULPHUR DELIVERIES

Radiating out from Cincinnati



This is the first of the TGS Terminal Molten Sulphur Truck and Rail Distribution Stations being set up to serve industrial areas of the country. Regular large tonnage barge shipments of Molten Sulphur from our mines in the Gulf area are keeping this Cincinnati Terminal well-stocked to meet the growing demand for Molten Sulphur in the Ohio River area.

Additional Molten as well as Solid Sulphur terminals are being considered for other parts of the country.

TEXAS GULF SULPHUR COMPANY

75 East 45th St., New York 17, N. Y. / 811 Rusk Ave., Houston 2, Texas

Sulphur Producing Units: Newgulf, Texas • Spindletop Dome, Texas • Moss Bluff, Texas • Fannett, Texas • Worland, Wyoming •

Molten Sulphur in tank *cars* can be delivered to any point in the States or Canada from our nearest mine or recovery plant. Barge deliveries of Molten Sulphur are available on all navigable inland waters. Solid Sulphur, as for many years, is deliverable all over the world. Large inventories at our mines assure industry it will get its supplies when needed.

These special steels that do more put money in the bank for you

Today's mining equipment built with USS High Strength Steel, super-strong USS "T-1" Steel or USS Stainless Steel is the biggest, brawniest and most durable ever made. It's true that these steels cost more per pound in most cases, but fewer pounds are needed. They cut dead weight, increase payload, boost service life, reduce downtime and save operating dollars. Every dollar you spend for these stronger, tougher, more abrasion-resistant steels puts money in the bank. For example, "T-1" Steel bucket teeth have outlasted other teeth from five to 10 times . . . and stainless steel filter screens have lasted 50 times as long as the material they replaced.

USS, COR-TEN, MAN-TEN, TRI-TEN and "T-1" are registered trademarks

Here are the USS Steels that do more:

USS MAN-TEN Steel—High strength with abrasion resistance and economy. (Minimum yield point 50,000 psi)

USS COR-TEN Steel—High strength with superior atmospheric corrosion resistance. (Minimum yield point 50,000 psi)

USS TRI-TEN Steel—High strength with toughness, weldability and abrasion resistance. (Minimum yield point 50,000 psi)

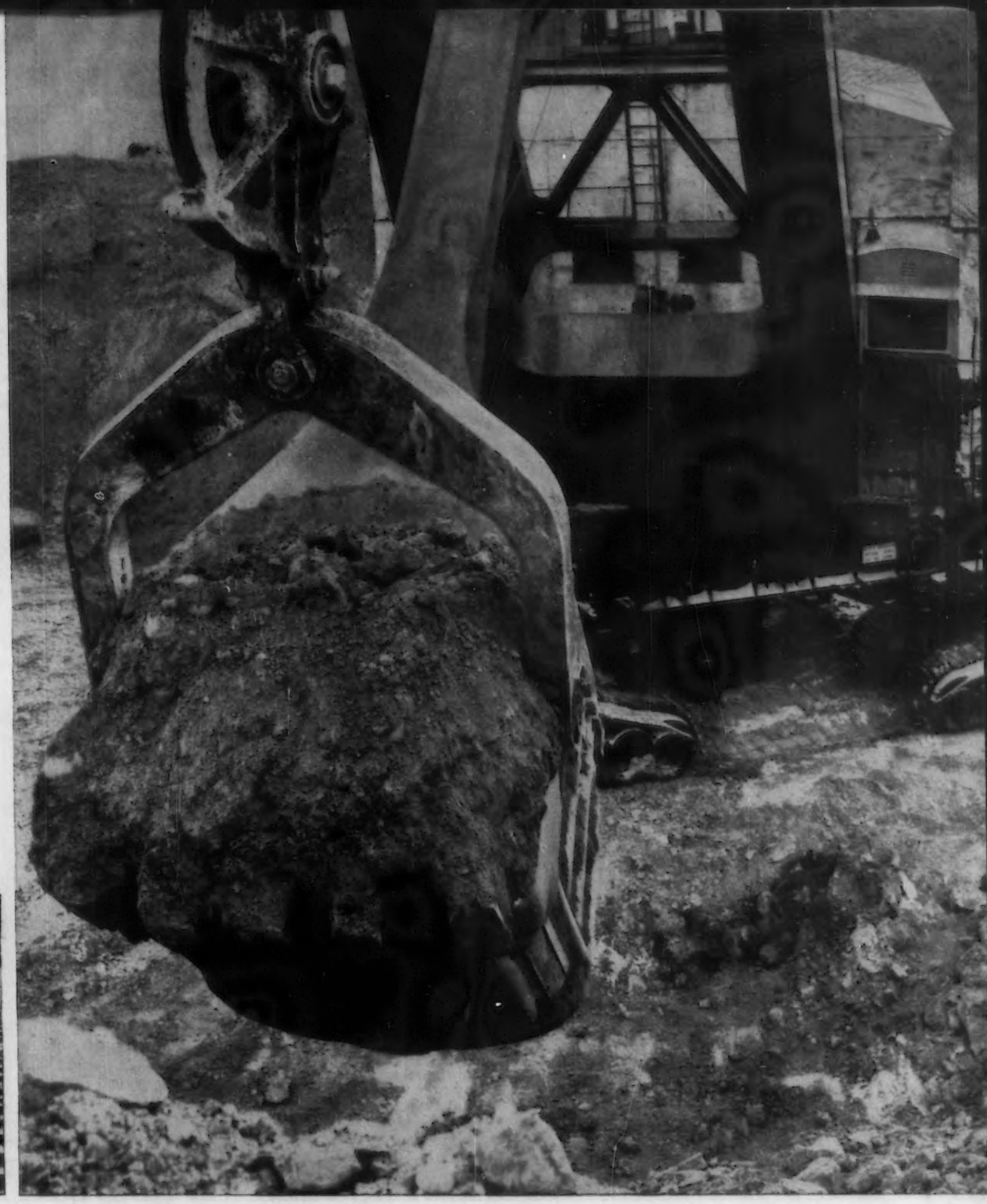
USS "T-1" Steel—Super strength with impact abrasion resistance, weldability and toughness. (Minimum yield strength 100,000 psi)

USS STAINLESS Steel—High resistance to corrosion, elevated temperature service and abrasion.

Each of these USS Steels is superior for certain applications. Our metallurgists will help you choose the best steel for your job. Contact our nearest sales office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

High Strength Steels in Alaska. Located 100 miles out in the bush, with the responsibility of mining 75,000 tons of coal annually, this earth-moving equipment hacks, dozes, hauls and scoops both coal and overburden the year round. Bulldozer blades and shovel buckets must be tough and independent—able to withstand extensive periods of 30° below zero weather. High strength steels stand up under this brutal punishment—keep production moving.

Stainless Steel vibrating screen handles more than 400,000 tons of run-of-mine coal at Island Creek Coal Co., Holden, W. Va. Present unit has lasted more than a year. Cost of screen runs about 0.3 cents per ton of coal processed. The same story of low-cost operation holds true at other mines where stainless steel is doing yeoman duty. Stainless Steel coal chutes eliminate the build-up of coal caused by week-end corrosion of the old chutes. Service life is greatly increased. Stainless vacuum filter screens remain in service a year against only a few weeks for previous screens.



5 times the life from USS "T-1" Steel. This 18-cu.-yd. shovel bucket has lips and teeth made from USS "T-1" Steel. The old teeth made of mild steel lasted about 80 hours. Another alloy lasted 160 hours. Now, with "T-1" Steel, they get a whopping 400 hours minimum. USS "T-1" Steel's outstanding resistance to impact abrasion made the difference and resulted in large savings. The teeth cost about $100 apiece. Now most of this is saved by the drastic cut in maintenance costs.

United States Steel Corporation – Pittsburgh
American Steel & Wire – Cleveland
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
United States Steel Export Company

United States Steel

USS

"I've seen our Ford Tandems pull out where others couldn't"

says Walter E. Carlson, President
Park Construction Company, Minneapolis, Minnesota

"We're still using the first Ford Tandems we bought in 1954!

"In the construction business, our trucks really take a beating. They have to be rugged and durable, and that's why we like our Ford Tandems. On one of our earth moving jobs, for example, our Ford T-800's are in constant operation an average of ten hours each day, traveling about two hundred miles. They climb out of the pit, loaded with twelve yards of dirt, and walk right up a 12% grade. In fact, I've often seen our Fords pull out of places where other trucks couldn't.

"My father, who started the business back in 1910 with a horse and wagon, bought one of the first Ford Trucks ever made. That was over 44 years ago—and we've used Ford Trucks ever since. We pioneered the use of Ford Tandem Axle Trucks in this area in 1954. Now we have a total of forty trucks, including thirty-five Fords.

"We completely overhaul our trucks at the end of each construction season. That way we keep them in top operating condition and they last longer. We like Ford service, too, because we don't have to tie up our money in a large parts inventory. We can always get the parts we need quickly from our Ford Dealer."

FORD TRUCKS COST LESS

'59 FORD PICKUPS GIVE 25.2% MORE MPG!

25.2% advantage delivered in Economy Showdown Tests means five days' driving on four days' gas

The nation's leading automotive research organization* proved and certifies that a '59 Ford Six Pickup will run five days on the same amount of gas the average competitive '59 pickup burns in four days.

The tests were made on 1959 six-cylinder ½-ton pickups of the six leading makes purchased from dealers – just as you would. The trucks were tested in every kind of driving–high and low speeds, open highway and city streets, even simulated door-to-door delivery. And in every test '59 Ford Sixes delivered more miles per gallon than any other make.

Here are the actual percentages:

HOW NEW '59 SIXES RATE IN GAS MILEAGE

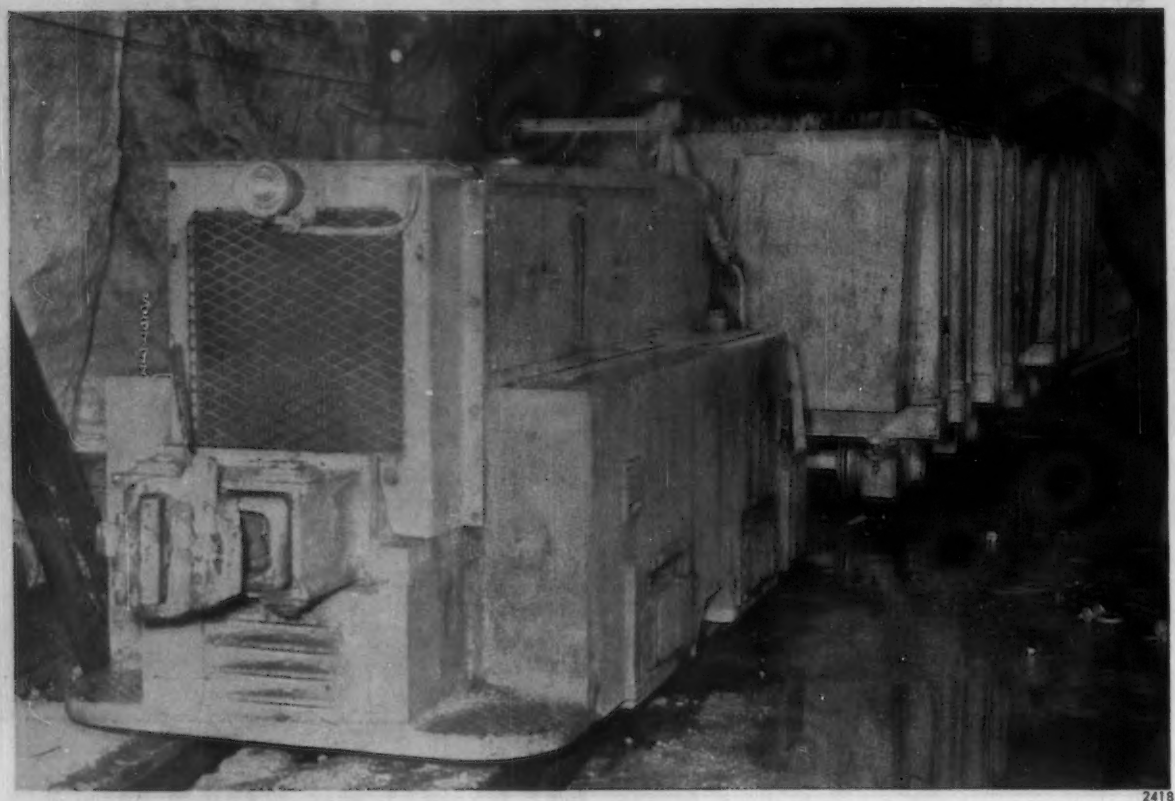
'59 FORD SIXES GIVE	25.2% more miles per gallon than Make "C"	31.1% more miles per gallon than Make "I"	9.6% more miles per gallon than Make "G"	42.6% more miles per gallon than Make "D"	22.0% more miles per gallon than Make "S"	25.2% more miles per gallon than the average of all makes

What's the secret of Ford's economy? First, of all pickup sixes, only the Ford Six has modern Short Stroke design which reduces engine friction and thus requires less fuel. Second, to this modern engine, Ford has added a new economy carburetor to meter fuel more precisely in both high- and low-speed ranges.

Your Ford Dealer has the complete report of Economy Showdown U.S.A. See him and get the whole story firsthand.

Go Ford-ward for savings!

**Name available on request.*
Send inquiry to P.O. Box 2687, Detroit 31, Michigan



2418

12-ton Mancha locomotive powered by a diesel engine rated 90 hp. at 1800 rpm and capable of developing 2500# tractive effort at 8 mph.

NOW!

10, 12 and 15 ton Mancha Diesels

for long, heavy hauls in metal mines and tunnels

Where loads are heavy and hauls are long no locomotives are better equipped to do the job than the diesel powered Manchas in 10, 12 and 15 ton capacities. These units reflect the precise engineering design typical of all Manchas. They provide minimum width and length, a short wheelbase for sharp radius curves, and simplicity of design for economical operation and low maintenance. Speed is throttle controlled. Motorman is protected with a heavy guard plate. Other quality features include:

- **Air brakes**
- **Water bath exhaust scrubber**
- **Heavy, all welded frame with 4" rolled steel side plates**
- **Good clearance above rail —min. 4¼"**
- **Battery starting**
- **Torque converter for smooth acceleration of heavier loads than are normally handled by locomotives of this weight**

Every Mancha locomotive is built for long, heavy duty service and efficient operation. Many are specially built to meet customers' exact specifications. For complete information write to:

2464

15-ton Mancha equipped with a diesel engine rated 113 hp. at 1800 rpm and capable of developing 4000# tractive effort at 9 mph.

MANCHA LOCOMOTIVE

DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois
Cable Address: Mancha, Chicago
Mancha representatives are located in principal mining areas throughout the world.

Send inquiry to P.O. Box 2687, Detroit 31, Michigan

Drill Steel helps move 900,000 cu yd for new mountain highway

These wagon drills, using Bethlehem Hollow Drill Steel, were photographed recently as they bored blast holes in hard sandstone atop Broad Mountain, in eastern Pennsylvania. The 2½-mile project, on winding Route 29 near Nesquehoning, was handled for the Pennsylvania Dept. of Highways by J. H. Beers; Howells Mining Drill Corp. serviced the drill steel. The Bethlehem Hollow, which comes in Carbon and Ultra-Alloy grades, turned in a low-cost job . . . just as it is doing in hundreds of rock removal projects across the nation.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Duval Sulphur & Potash Co., Carlsbad, N. Mex.

He's taking clay to the cleaners

A 400-pound problem—clay—rides piggyback into this tank on each 20 tons of sylvinite ore.

The clay clings tight to the crushed crystals of potash and rock salt. If the heavy clay ever got beyond the tank and into the flotation cells, where potash and rock salt are separated, it could raise havoc with plant production figures.

But it never does. Good fluid mixing, with a LIGHTNIN Mixer, washes the sticky clay from the crystals—24 hours a day, seven days a week. As a result, the flotation process can work at top efficiency all the time.

Balanced mixing A trio of 30-hp LIGHTNIN Mixers with big turbine impellers drive saturated brine and ore, at 60% solids, in constant vigorous flow throughout this 5,600-gallon tank and two others. Powerful mixing action combines *fluid flow* and *turbulence* in the right balance to wipe crystals clean, wet them thoroughly, and suspend them uniformly in the cell feed.

Clouds of corrosive chloride dust from the dry ore, and salt spray from the brine troughs, don't bother these rugged mixers. Their working parts have the most complete weatherproofing protection available in any speed reducer.

You get more out of your ore when you mix with LIGHTNIN Mixers. You can get them in sizes up to 500 hp, in hundreds of standard power-speed combinations, factory-aligned and ready to install.

Most important, LIGHTNIN Mixers give you guaranteed results—results you can *measure* in terms of faster throughput, better extraction percentages, closer quality control, more product from fewer reactors.

Ask us to show you how and why. Just call your LIGHTNIN Mixer representative. He's listed in Thomas' Register. Or write us direct.

WHAT MIXING OPERATIONS ARE IMPORTANT TO YOU? You'll find a wealth of information on fluid mixing in these helpful bulletins describing LIGHTNIN Mixers:

- ☐ Top or bottom entering; turbine, paddle, and propeller types: 1 to 500 hp (B-102)
- ☐ Top entering; propeller types: ¼ to 3 hp (B-103)
- ☐ Side entering: 1 to 25 hp (B-104)
- ☐ Portable: ⅛ to 3 hp (B-108)
- ☐ Laboratory and small-batch production types (B-112)
- ☐ Condensed catalog showing all types (B-109)
- ☐ Quick-change rotary mechanical seals (B-111)
- ☐ Data sheet for figuring mixer requirements (B-107)

Check, clip and mail with your name, title, company address to:

MIXING EQUIPMENT Co., Inc., 234-h Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.

Lightnin® Mixers

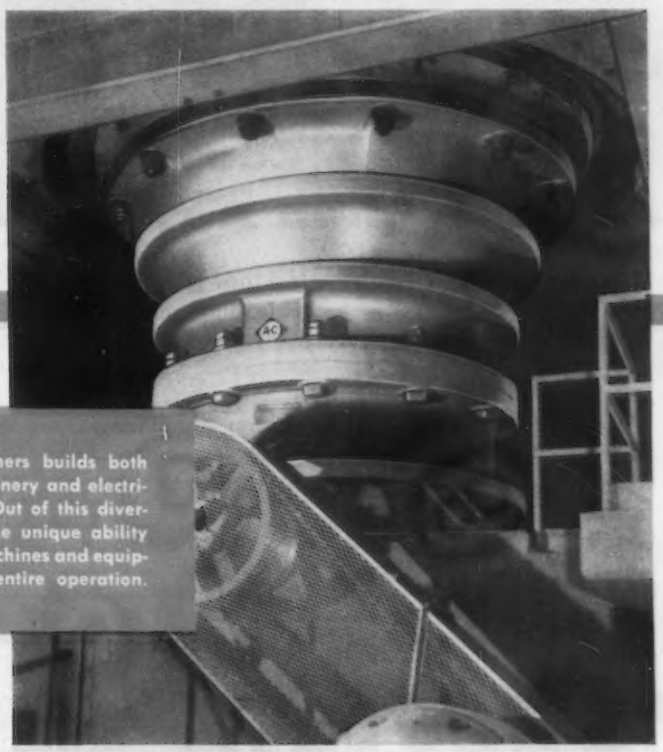
MIXCO fluid mixing specialists

metal mining modernization

Modernization starts with this booklet

"Work Index" formula detects inefficiency... prevents misapplication

Engineers call it the Third Theory of Comminution. This "Work Index" formula offers the only scientific method of determining equipment size and horsepower requirements. Used in your modernization planning, it will detect inefficiencies in your present setup — facilitate compiling application data — indicate type and size of equipment. Ask for Bulletin 07R7995. *See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.*



Only Allis-Chalmers builds both processing machinery and electrical equipment. Out of this diversity has come the unique ability to coordinate machines and equipment for your entire operation.

ALLIS-CHALMERS

A-5990-MM

¿COBRE?*

35 SL

More Cobre* Companies Use ~~KW-DART~~ than Any Other Make!

The fact that more copper mines use KW-DART Trucks than any other make is definite evidence of superior performance records over many years of operation.

Custom-engineered to meet varying conditions, KW-DARTS haul more payload at less cost . . . may we send a KW-DART sales engineer to show you why?

* *Spanish for COPPER*

KW-DART TRUCK CO.

Subsidiary of Pacific Car and Foundry Company

147

1301 North Manchester Trafficway P. O. Box 321 Kansas City 41, Missouri, U. S. A.

SERIES 9000
For continuous service, heaviest and coarsest materials.
SERIES 8000
For continuous operation, heavier-weight, abrasive materials.
SERIES 7000
For continuous operation, heavyweight, abrasive materials.
SERIES 6000
For intermittent operation or continuous handling of lightweight material.
SERIES 5000
For intermittent or light service, fine or small lump materials.
5

series of belt conveyor idlers

end wasteful over and under-engineering

LINK-BELT's complete line is your best insurance against high replacement and maintenance costs

Yes, industry's broadest belt conveyor idler line permits "pin-point" selection that results in substantial savings in purchasing and maintenance—avoids wasteful over or under-engineering. Five series in over 630 types range in application from light or intermittent service to continuous heavy-duty operation—in both 20° and 45° troughing for a broad range of belt widths—with rolls of various diameters, materials and coatings. 15.101

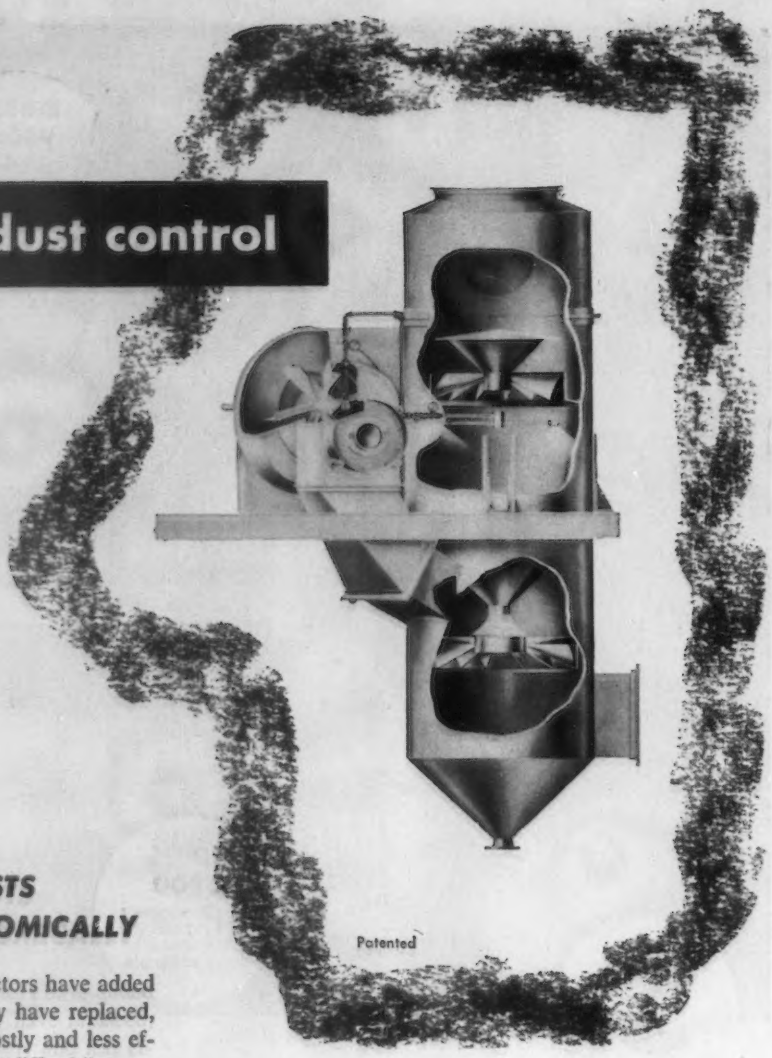
For further facts on this broad line—contact your Link-Belt office or authorized stock-carrying distributor. Look under CONVEYORS in the yellow pages of your phone book. Or write for new Catalog 2716.

LINK-BELT

BELT CONVEYOR IDLERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

. . . in wet dust control



NEW DUCON DYNAMIC WASHERS

RECOVER DIFFICULT DUSTS EFFICIENTLY AND ECONOMICALLY

Ducon UW-4 Dynamic Wet Dust Collectors have added a new dimension in dust recovery. They have replaced, with outstanding success, many more costly and less effective dust collectors in the recovery of "difficult" materials, such as fine and abrasive dusts in kilns, rotary driers and other applications.

The UW-4 Washers are also ideal for high loading conditions where maximum efficiency is desired.

Ducon UW-4 washers offer other unique advantages, including constant air capacity, low water consumption and rugged construction. They are self-cleaning and fire and explosion proof.

For complete information write for Bulletin W-7456.

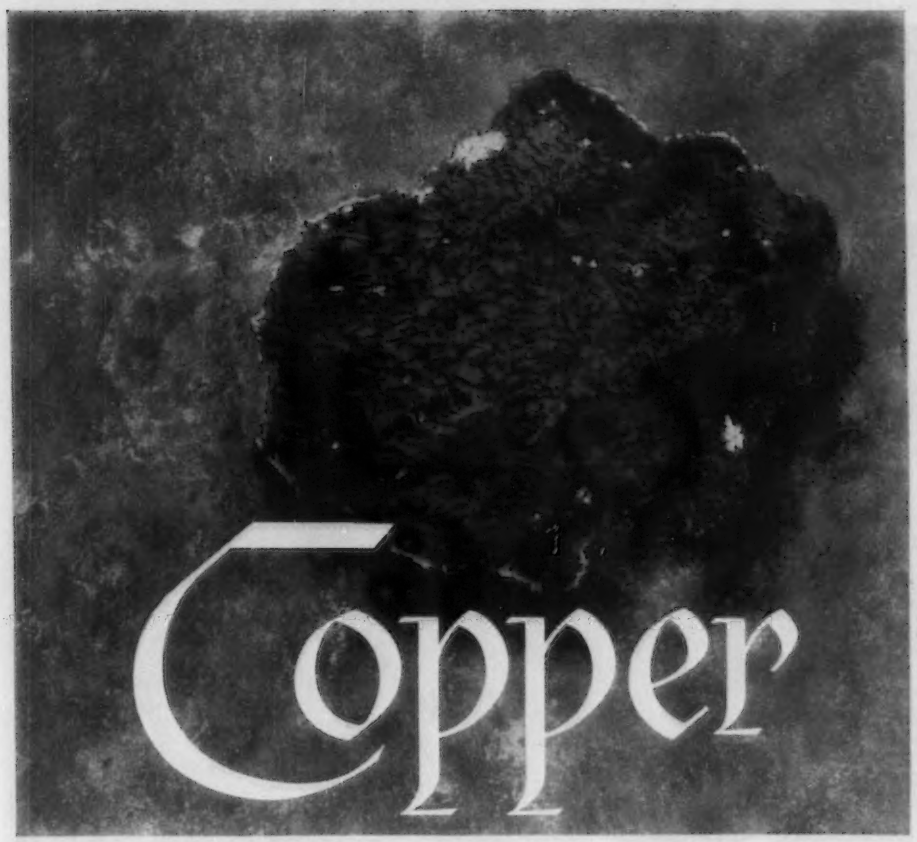
DUST CONTROL SYSTEMS AND EQUIPMENT — DUCON

the name in DUst CONtrol

THE Ducon COMPANY INC.
147 EAST SECOND STREET • MINEOLA, L. I., NEW YORK

Canadian Branch:
THE DUCON COMPANY of CANADA, Ltd.,
1131 Pettit St., BURLINGTON, ONTARIO

CYCLONES • CENTRIFUGAL WASH COLLECTORS • TUBULAR CLOTH FILTERS • DUST VALVES

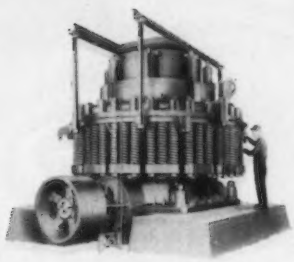


. . . symbol of money and power

The name *copper* is from the Greek κυπρος, Cyprus, one of the early sources of the metal. Copper has often been called "the common man's gold"—and has become a symbol of *money* due to its wide usage in the coins of many nations, as well as a symbol of *power*—since the greatest usage of copper has been as a conductor of electricity.

While native copper is the only metal found abundantly in nature, commercial production is supplied chiefly from various ores of copper, including chalcopyrite, chalcocite, cuprite and malachite.

Wherever these copper ores are processed—in Arizona, Chile, or the Belgian Congo—you'll find Symons Cone Crushers the leading choice among the world's prominent producers. For in copper . . . *as in all of the important ore and mineral operations around the world* . . . Symons Cone Crushers have consistently maintained their prominent position by efficiently processing large tonnages of finely crushed product at low cost.



SYMONS® CONE CRUSHERS
. . . The machines that revolutionized crushing practice . . . are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

SYMONS . . . a registered Nordberg trademark known throughout the world

©1959, N. M. CO. C659

NORDBERG

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

RUGGEDNESS...

A MAJOR FACTOR IN THE LOW MAINTENANCE AND HIGH AVAILABILITY OF LECTROMELT FURNACES

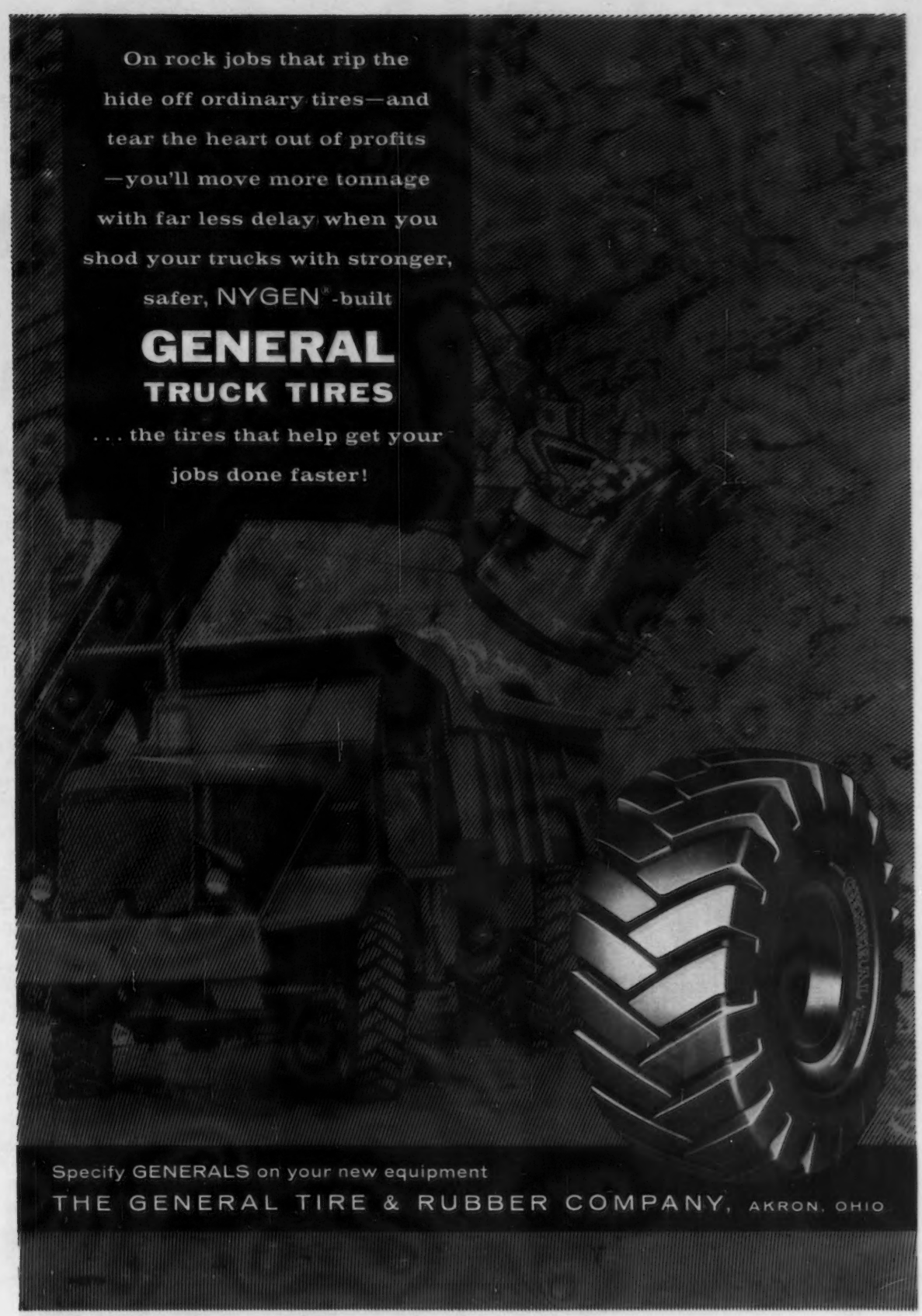
When you're selecting an electric furnace, compare design details and you'll note the heavier, sturdier construction that Lectromelt provides. This pays off for you in *service*—Lectromelt furnaces enjoy a world-wide reputation for high availability and low maintenance.

Lectromelt is the world's most experienced builder of electric furnaces. Whether your needs are for 200-pound or 200-ton capacities, it will pay you to get Lectromelt's recommendations when planning additions or replacements. Catalog 10 contains full information.

Lectromelt Furnace Division, McGraw-Edison Company, 322 32nd Street, Pittsburgh 30, Pennsylvania.

FOR THE MOST DEPENDABLE MELTING **Lectromelt®** McGRAW EDISON

CANADA: Wild-Barfield Electric Furnaces, Ltd., Toronto...ITALY: Forni Stein, Genova...ENGLAND: G.W.B. Furnaces Limited, Dudley, Worcs...GERMANY: Demag-Elektrometallurgie, GmbH, Duisburg...SPAIN: General Electrica Espanola, Bilboa... FRANCE: Stein et Roubaix, Paris...BELGIUM: S.A. Stein & Roubaix, Bressoux-Liege...JAPAN: Daido Steel Co., Ltd., Nagoya


On rock jobs that rip the
hide off ordinary tires—and
tear the heart out of profits
—you'll move more tonnage
with far less delay when you
shod your trucks with stronger,
safer, NYGEN®-built
GENERAL
TRUCK TIRES
. . . the tires that help get your
jobs done faster!
Specify GENERALS on your new equipment
THE GENERAL TIRE & RUBBER COMPANY, AKRON, OHIO

For that extra margin of Safety . . .

Specify Blaw-Knox Electroforged® Steel Grating and Treads

Men working around cars on a trestle must have sure footing in any weather. Blaw-Knox Electroforged Steel Grating with its non-slip twisted crossbar provides a walking surface that is safe and clean. Snow does not pile up and freeze, and rain cannot form puddles. Spillover from cars falls through, making frequent cleaning unnecessary.

Electroforging also insures structural strength. Bearing bars are not weakened by slotting in fabrication. Rigid one-piece construction has no bolts or rivets to work loose under strain.

One-piece construction cuts easily to fit neatly around pipes and beams. No alteration of existing structures is required.

For information on how to specify the Blaw-Knox Electroforged Steel Grating best suited to your needs, write for your copy of Bulletin 2527-R.

BLAW-KNOX COMPANY

BLAW-KNOX

Blaw-Knox Equipment Division
Dept. S, Pittsburgh 38, Pa.

NOW..clam-action 4-in-1 PLUS values in NEW TD-6 and TD-9 crawlers!

NEW 6-cylinder diesel smoothness and power wallop! Both the new TD-6 and TD-9 Four-in-One's are powered with the millions-of-hours-proven, direct-starting, 6-cylinder International UD-282 diesel. Naturally-aspirated in the TD-6, it produces 55 net engine hp; turbocharged in the TD-9, it delivers 71 net engine hp!

New job-getting efficiency! Both the new TD-6 and TD-9 Four-in-One's have increased track length, for new tough-job stability and flotation. Both are geared with new speeds for greater tough-job capacity. Both have the power-transfer efficiency of new full-face, sintered metal engine clutches.

And both the new TD-6 and TD-9 have exclusive vented track-roller and idler shafts, assuring positive seal protection from over-lubrication. Big 300%-increased lube capacity shells provide 500-hr. track-roller greasing intervals!

Move the selector lever! Prove versatility unlimited of exclusive 4-in-1 as Skid-Shovel; space-saving, bottom-dumping clamshell; full-sized bulldozer; inch-close-accurate "carry-type scraper." Add up how many tens of thousands of dollars a new TD-6 or TD-9 four-in-one can save you, doubling for one limited-duty rig after another! Measure the plus value of exclusive shock-swallowing Hydro-Spring. See your International Drott Distributor for a demonstration!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®

New 1⅛ cu. yd. International Drott TD-6 Four-in-One. New TD-9 Four-in-One has 1½ cu. yd. bucket capacity.

Measure new 34 cu yd International Payscraper advantages

NEW power-to-payload hauling, jam-proof ejection

You can heap up to 34 cu. yd. on a 2-axle International 295 Payscraper (or a 3-axle "495" model). You can operate as fast as 32 mph.—faster, even than smaller rigs of other makes.

You've got industry-topping, power-to-payload wallop in these giant new models. You get the sock of 375 high-torque turbocharged diesel "horses" from International's fuel-thrifty new DT-817 six-cylinder diesel. You get direct, push-button starting; all-altitude high-efficiency performance.

Exclusive bowl "with a flare" loads and keeps bigger heaps!

Exclusive new Payscraper tapered bowl design outcycles "slow loaders," "load spillers," and "reluctant dumpers." Widest of all cutting widths—131 inches—lets scraper wheels and pusher operate inside the cut, the best traction zone. Wide-cutting bowl and center rolling boil-in speeds heap loading. The tapered bowl is a superior heapholder even at the faster haul speeds. Obstruction-free bowl provides fast, positive jam-proof ejection.

Operators become full-time earthmovers!

Minute-stealing operating delays are eliminated, with speed-gaining, balanced design. The 295 Payscraper operator, for example, commands ample power and traction to pull out of 90° turns—even on soft fills—without time-losing back-ups.

The operator rides in cushioned comfort in a 16-adjustment seat that smothers bumps. He has reach-easy power brakes, "control tower" vision, flush deck safety. For the first time in big 2-axle scraper history, the operator becomes a confident, full-time, full-capacity dirt-mover!

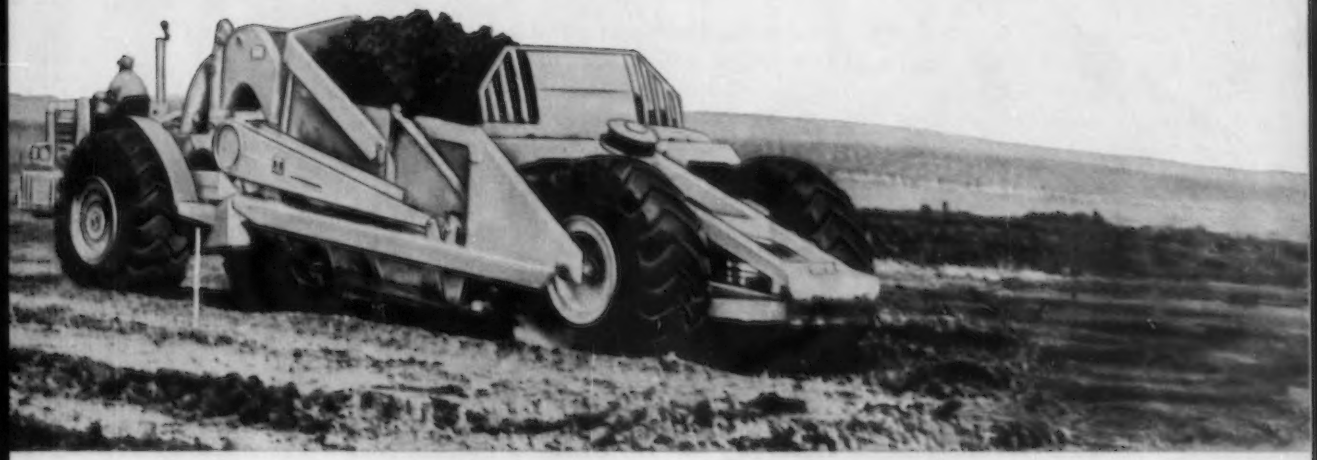
From power to push-block—from fuel thrift to dirt on the fill—compare new giant-sized International Payscraper models to anything else on wheels. Note how they lead in turbocharged diesel horsepower. Match exclusive tapered-bowl scraper advantages against less-advanced design. Size up strength—ease of control—speed—capacity! See your International Construction Equipment Distributor!

International® Construction Equipment

International Harvester Co., 180 North Michigan Avenue

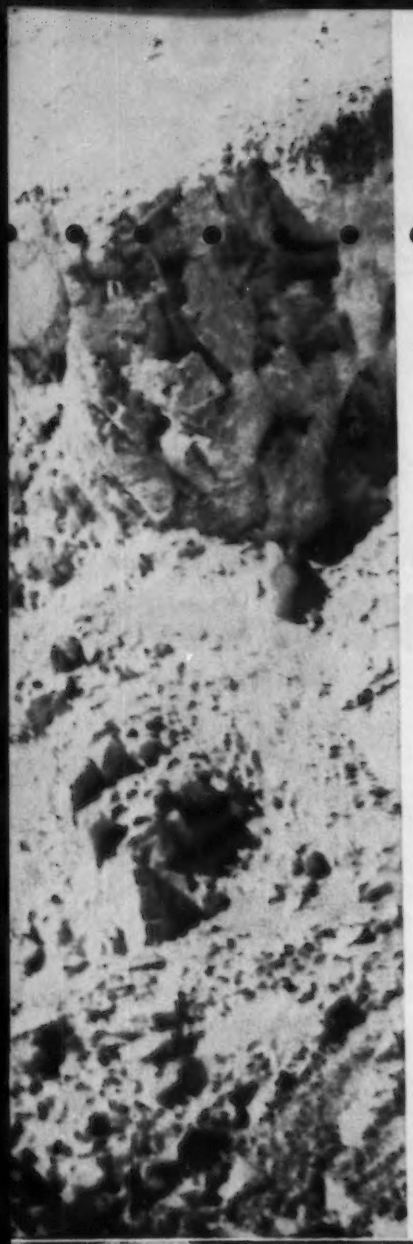
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

wallop...NEW speed loading,
NEW full-power 90° turning



Three "295's" of a 6-unit Payscraper fleet, building new superhighway near Beloit, Wisconsin. Both the "295" and "495" feature International's fast-acting, finger-tip controlled model 280 cable control unit—built to give you high capacity; simple adjustments; low upkeep! Positive, forced ejection, plus gaping 98" apron opening, assures fast, positive dumping of all materials. Even gummy, barrel-sized blue clay chunks are quickly ejected—as this "495" view proves, on an operation of V. H & M Construction Co., Denham Springs, Louisiana.

"Our blasting days are over



. . . with the TD-24"

—Wrightwood White Rock Co.,

Wrightwood, California

"With the International TD-24 our need for explosives to shatter rock is eliminated," declares Owner Dale Douce, Wrightwood White Rock Co. "The '24' can do a better job than dynamite at a fraction of the cost."

The TD-24 removes a 40-foot overburden from the 1,000-foot-thick deposit—rips the rock into fragments, dozes it down to the loading level.

It's typical of the tough rock jobs which so many miners and quarrymen are doing to best advantage with Planet Power-steered TD-24's—against any other method or machine!

How TD-24's double for dynamite Sometimes it even takes two king-sized, clutch-steered crawlers to equal one Planet Power-steered TD-24 on rough, tough rock-moving. Exclusive, years-proved Planet Power steering gives your operator full-time "live" power on both TD-24 tracks—full-time separate and positive control of each track! And full-time, on-the-go Hi-Lo (up or down!) power-shifting.

Load-limiting and load-spilling "dead-track drag" is eliminated, because Planet Power steering keeps the full payload on the move even on turns. Gives bonus-load follow-through when ripping or dozing rock. Equalizes track speed for full-bite benching!

Prove the amazing production increase Planet Power-steered TD-24's can give and keep giving you—"blasting" through rock or other tough materials—or on everyday overburden removal. Compare TD-24 undercarriage strength—long, heavy-duty track-roller life and maintenance ease—precision sealing of parts—to anything else on tracks! See your International Construction Equipment Distributor for a demonstration!

"I always feel confident in the big TD-24, even working on the edge of benches with a sheer 100-foot drop," reports Operator Lloyd Medlock. "Positive steering control, good brakes and excellent balance make the TD-24 a safe tractor even in hazardous work like ours."

This quarry produces an exceptionally white, high-calcium (98%) limestone—widely used for roof-covering in the Los Angeles area; also by glass and chemical manufacturers. Note the rock-shattering job being done by the TD-24-powered Ateco ripper!

International® Construction Equipment

International Harvester Co., 180 North Michigan Avenue

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

Wilfley's "Quick-Change" FEATURES Cut DOWNTIME... MAINTENANCE COSTS

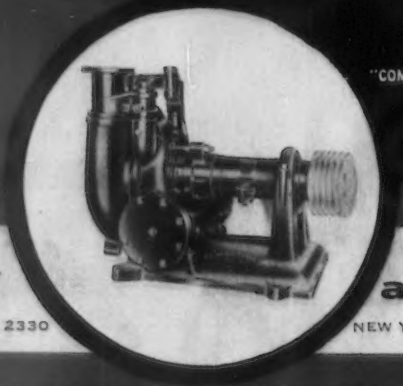
Wilfley parts can be changed in a matter of minutes — and without disturbing the intake or discharge piping. This "quick-change" — another Wilfley exclusive — is an important cost-saving advantage to economy-minded plant operators.

WILFLEY SAND PUMPS

Add to this Wilfley's simplified, packingless design, trouble-free operation, rugged construction, and long life... these are the features that make Wilfley "the" name in sand pumps.

To give you maximum economy in solids pumping every Wilfley installation is JOB ENGINEERED

Write, wire or phone for complete details.



WILFLEY ACID PUMPS
"COMPANIONS IN ECONOMICAL OPERATION"
WILFLEY SAND PUMPS

A. R. WILFLEY and SONS, INC.

DENVER, COLORADO, U. S. A. P.O. BOX 2330

NEW YORK OFFICE: 122 E. 42ND ST., N.Y. CITY 17

ENGINEERING AND MINING JOURNAL

AUGUST 1959

The JETS—A 4-H Club for the Engineering Profession

"At the end of the next seven years (1965) the Soviet Union will be the world's biggest producer of iron ore."—This is one of the many aims of the Soviet Government posted at the current industrial, scientific and cultural exhibit at the Coliseum in New York City.

At the opening of the exhibit it was announced that the Soviet Government plans to surpass the U.S. in industrial and scientific achievement. A few displays, designed for visitors with advanced engineering comprehension, indicate that a race for supremacy is on. Here are a few subjects covered in the displays:

(1) Several methods for the magnetic containment of plasma (dissociated atomic constituents at extremely high temperatures) to produce energy by fusion.

(2) Models of a 500,000-kw atomic energy plant and a nuclear-powered ice breaker (already commissioned).

(3) Conquest of space with heavy satellite. (Full scale duplicates of those already launched are on exhibit.)

(4) Measurement and mapping of secular microisostasy (in units of 0 to 10 mm per year) in Soviet Europe. This study will be used to plan "long-range" hydro-electric power projects and transportation.

(5) Survey and mapping of the distribution of the rarer minerals in magmas as an aid to the discovery of orebodies.

(6) Explanation of adsorption and its influences on catalytic processes.

What this great Soviet surge for scientific achievement indicates is that the youth of the Free World will have to learn more, better and faster than previous generations to stay on top in the fields of science and industry.

Fortunately, an effective program called the JETS (Junior Engineering Technical Society) was organized by Michigan State University in 1950 to stimulate greater interest in science and engineering in high schools. It derives its support from industry. Today there are more than 500 chapters in 40 states and Puerto Rico.

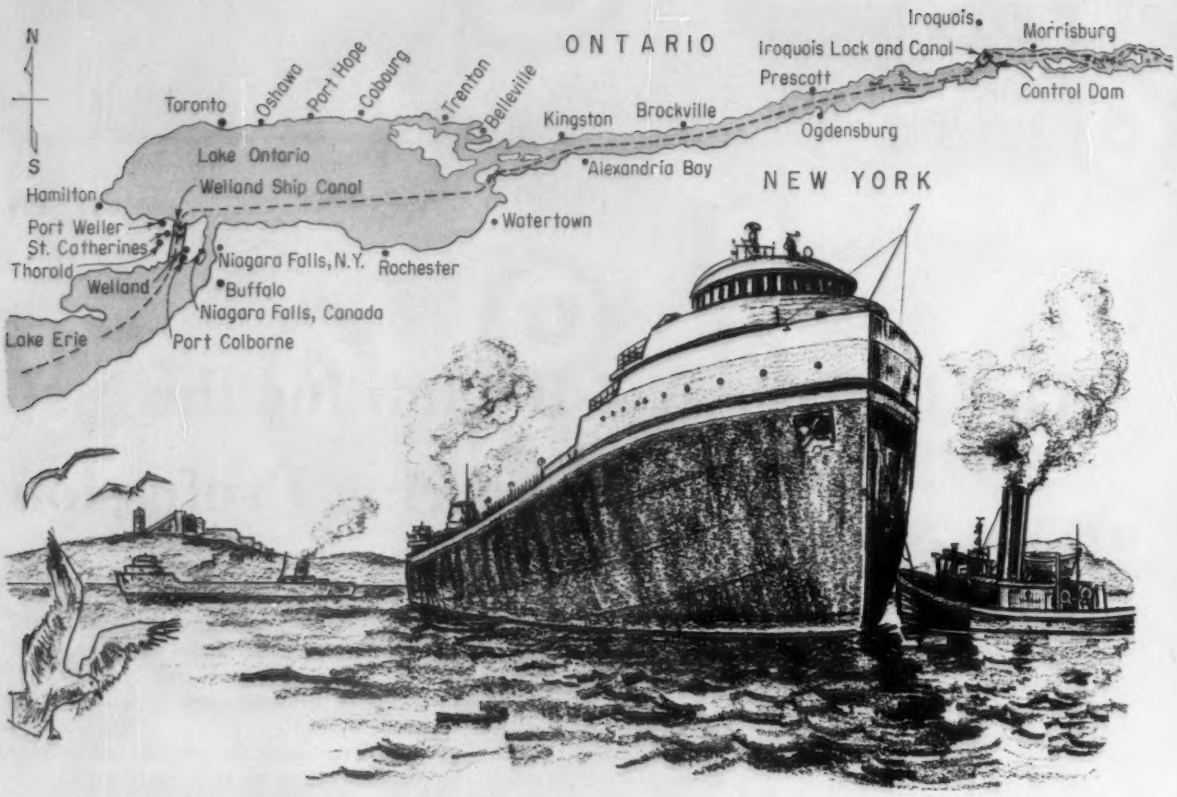
It is called the "4-H Club" of the engineering profession because it is analogous in objectives to the organization which so successfully promotes interest in agriculture for youth.

JETS sponsors engineering scholarships, awards modest prizes to high school students or groups which undertake such projects as building or demonstrating electronic digital computers, photomicrography of crystals, radioactivity, reflecting telescopes, electrostatic separation of material, etc.

Bi-weekly papers are sent out to train high school instructors on 33 subjects including quality control, dynamics, machine elements, magnetism, sound, metallurgy and crystallography, nuclear science, etc.

The organization assists in providing speakers, literature, career guidance and other aids to future engineers and scientists. Its board includes dedicated men in industry, research, education and government. It's a working organization of demonstrated effectiveness doing the most critical job ahead—that of encouraging youth to study science and engineering. For isolated mining operations, the JETS is an ideal organization to bring the world of science to high school students.

The work of the JETS is merely outlined here. For more information write to E&MJ or to JETS, Inc., Box 589, Lansing, Mich.



St. Lawrence Seaway Offers New Avenue

AN IMPORTANT new influence in Canadian-U.S. mining came to life with the opening of the St. Lawrence Seaway—officially dedicated June 26 by Queen Elizabeth and President Eisenhower.

Even before the dedication, ore ships had begun using what is probably the greatest international transportation and power development in North America. Forty per cent of the $425-million cost is expected to be paid for, in 50 years, by iron ore alone. An estimated 150-million tons are to be shipped in the next decade, even though ice will close the river four months out of each year.

The Seaway will generate over 3.24-million kw of electric power—nearly twice as much as the Grand Coulee Dam—and is expected to open the Great Lakes and St. Lawrence River ports to the world. The project was built by two U.S. and two Canadian governmental agencies. Canada spent over $285-million while the U.S. share of this cost was $140-million.

The Seaway begins 30 miles below Quebec City in the St. Lawrence Ship Channel which extends up to Montreal. From Montreal, a vessel sailing the Seaway navigates seven locks and by-passes three power dams before entering Lake Ontario, on the way to the Welland Ship Canal over 400 miles distant.

Power To Come

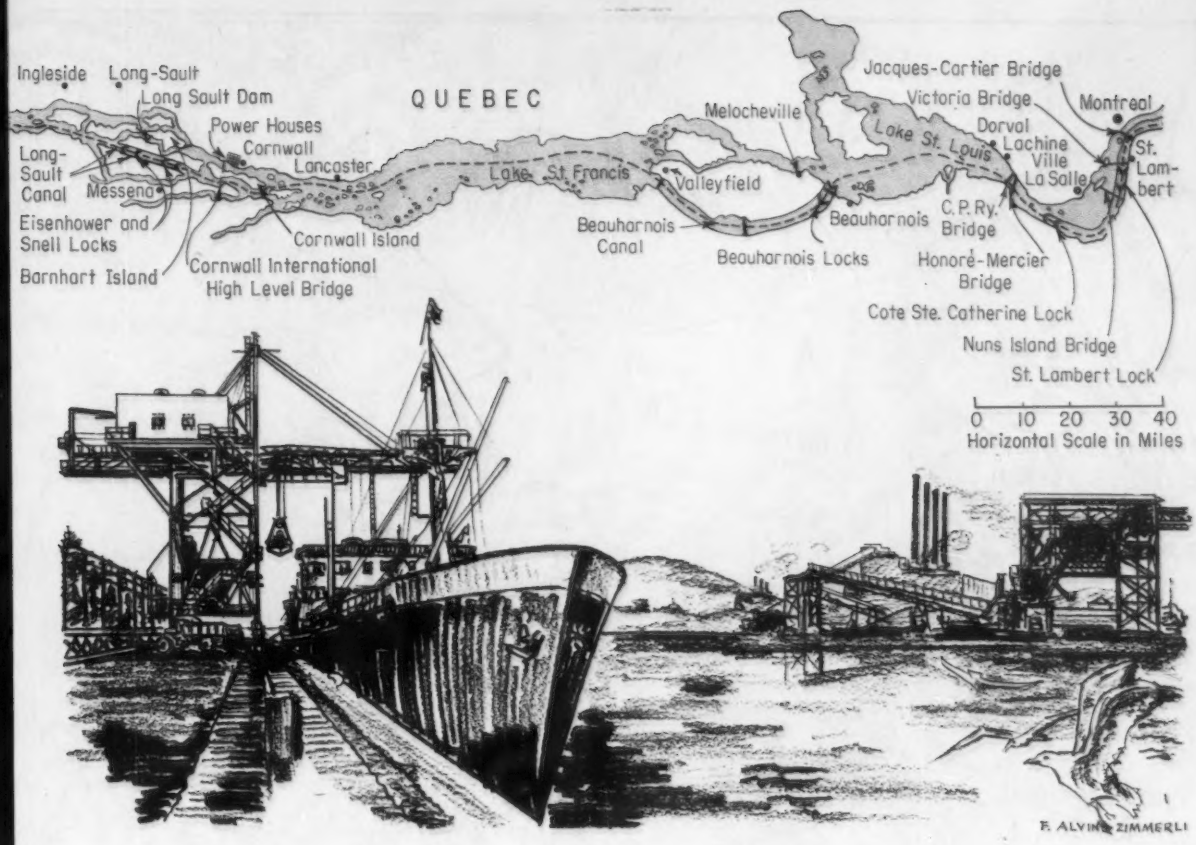
Seaway locks are 80 ft wide and 768 ft long, capable of handling ships of 27-ft draft. New channels were dredged to carry the 27-ft vessels. The three new dams, Barnhart Island Dam and powerhouse, Long Sault Dam and Iroquois Dam are expected to generate over 1.57-million kw of electrical power for industrial and commercial use in vast areas on both sides of the international border. An additional all-Canadian development at Beauharnois, to be completed in 1961, is expected to have a capacity of 1.67-million kw.

The power project was built cooperatively by the New York State Power Authority and the Ontario Hydro-Electric Power Commission. New York's Power Authority was established as a non-profit commission by the State of New York and instructed to build and operate the St. Lawrence power project as well as another at Niagara Falls. Ontario Hyrdo-Electric is a long-established provincial government unit which furnished electric power to the entire province of Ontario.

Each nation shared in the construction, paid for and owns half of the Barnhart Dam and each will get, to the kilowatt, the same amount of electricity. Long Sault and Iroquois are control dams, owned by Canada.

The shipping project also has two counterparts. One share, the U.S. part, is owned and operated by the St. Lawrence Seaway Development Corp., a Government agency created by Congress; in Canada, the agency is the St. Lawrence Seaway Authority of Canada.

Informed estimates predict that rich iron ore from the barely tapped Quebec and Labrador fields (see



For Output of Canadian and U.S. Mines

map, pp 84-85) will constitute at least 30% of the entire Seaway traffic. In the first five years, ore shipments are expected to average 10-million tons annually. Before the end of the second five-year period this total will have increased, it is expected, to close to 20-million tons a year. The first figure represents about 30% of the total traffic in those years and the second figure better than 40%.

As such, ore could well be the major factor controlling the establishing and future revising of toll rates charged on all bulk cargoes. Administrators of the Seaway must maintain a toll that will attract the maximum tonnage of iron ore.

U.S. backing for the Seaway project was delayed many years. Steel makers of the Midwest provided the final support that made U.S. participation in the project a certainty. This support did not materialize, however, until the Quebec-Labrador deposits were established. Before the Labrador ore became available many steel makers feared competition from foreign ore shipped by the Seaway.

Reserves in the Labrador trough are estimated in billions of tons and U.S. firms have invested heavily in their development. More than $300-million was spent in the area before the first ton of ore was shipped. Two companies, Iron Ore Company of Canada—controlled by Hanna and Canadian interests—and Quebec Cartier, are both building concentrators which will produce, sometime in the early 1960's, about 16-million tons of concentrate, grading 65-66% iron.

Tolls and Tonnage

Concentration is expected to increase the value of the Seaway to the mining companies since tolls will be levied on a tonnage basis. As a result, concentrates may move largely through the Seaway, with direct-shipping ores moving to East Coast points.

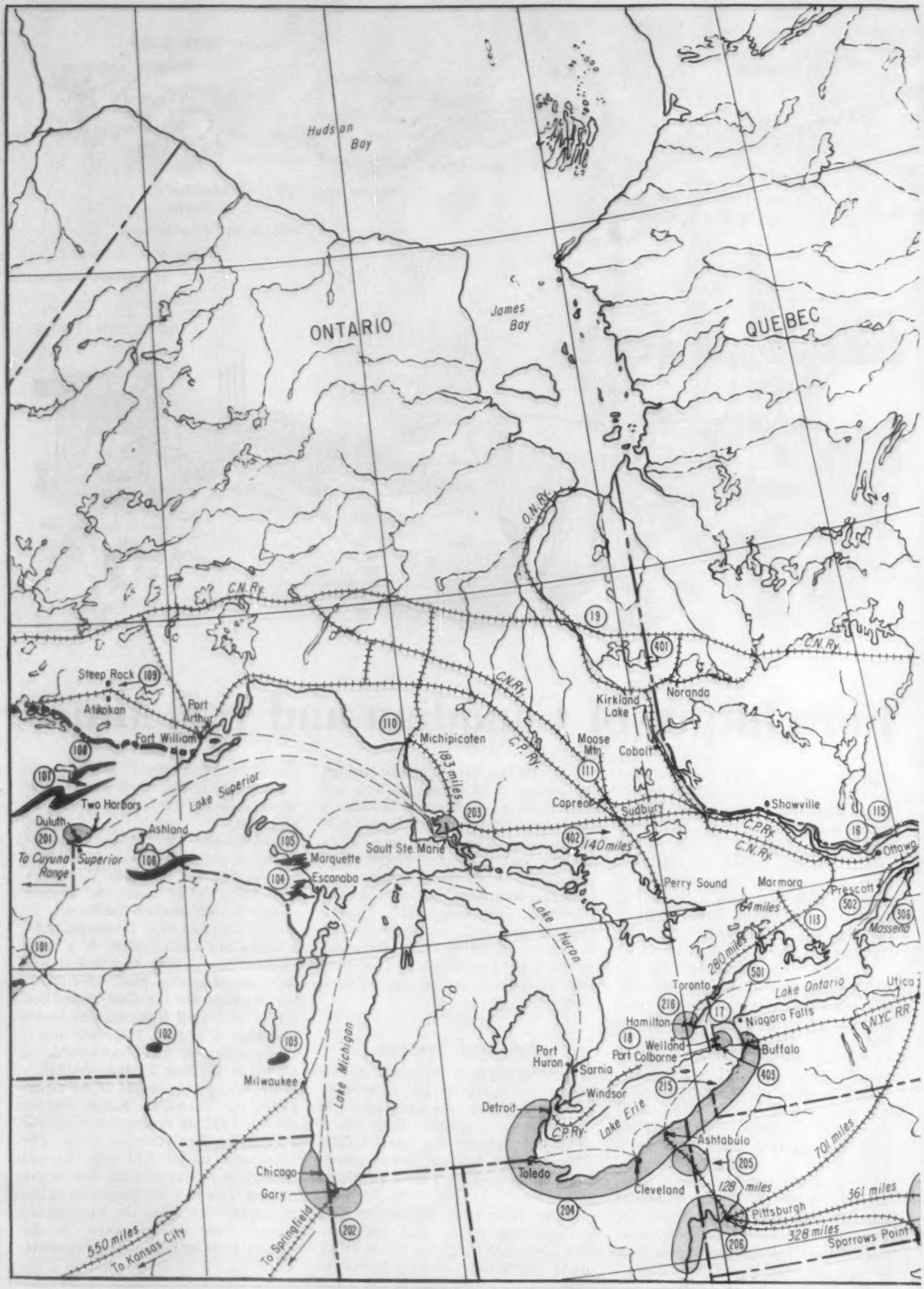
There have been suggestions that at least one major steel interest—that controlled by Cyrus Eaton—may avoid the Seaway entirely by establishing a steel plant at or near Contrecoeur on the south shore of the St. Lawrence River, 25 miles east of Montreal.

Contrecoeur, as the major transshipment point for Quebec-Labrador ore moving by rail into Pittsburgh and other U.S. mills, is already equipped with modern facilities.

One Canadian firm, Dominion Steel & Coal Corp. controlled by A. V. Roe Canada, has already said that it will build a fabricating plant at Contrecoeur which, for the time being, will get its basic steel from the company's operation at Sydney, N.S. (see map).

According to R. S. Archibald, in his 1959 Jackling Lecture (AIME), of the major iron ranges in the Great Lakes, the Vermillion Range, discovered in 1882, is expected to continue shipping to Two Harbors, Minn. The Marquette Range will ship its ore through the locks at Sault Ste. Marie to the furnaces of southern Lake Michigan. Ore from the Menominee Range, with its operations in the Crystal Falls and Iron River districts,

(Continued on p 86)


Hudson Bay
James Bay
ONTARIO
QUEBEC
O.N.Ry.
C.N.Ry.
C.P.Ry.
Steep Rock
Atikokan
Port Arthur
Fort William
Two Harbors
Lake Superior
Duluth
Superior
Ashland
To Cuyuna Range
Marquette
Escanaba
Sault Ste. Marie
Michipicoten
183 miles
Kirkland Lake
Noranda
Moose Mtn.
Cobalt
Capreol
Sudbury
140 miles
Shawville
Ottawa
Perry Sound
Marmora
64 miles
Prescott
Massena
280 miles
Toronto
Lake Ontario
Utica
Hamilton
Niagara Falls
N.Y.C. RR
Welland
Port Colborne
Buffalo
Port Huron
Sarnia
Windsor
Detroit
Lake Erie
Ashtabula
Lake Huron
Lake Michigan
Milwaukee
Chicago
Gary
Toledo
Cleveland
128 miles
Pittsburgh
361 miles
328 miles
Sparrows Point
701 miles
550 miles
To Kansas City
To Springfield

New Quebec-Labrador Iron Belt
To Ungava Bay
Schefferville
116
LABRADOR
Seven Islands to Rotterdam 2818 miles
Wabana to Rotterdam 2340 miles
Wabush Lake
Mt. Wright
QNS&L.Ry.
360 miles
Allard Lake
26 miles
117
Havre-St. Pierre
Wabana
118
217
C.N.Ry.
NEWFOUNDLAND
1
Seven Islands
301
Baie Comeau
508
Murdochville
405
Gulf of St. Lawrence
Sydney to Wabana 420 miles
Liberia to Sydney - 3500 miles
Monrovia to Ashtabula - 4860 miles
Sao Paulo to Montreal 5600 miles
507
Matane
Mont-Joli
St. Lawrence River
303
506
Isle Maligne
Arvida
302
505
C.N.Ry.
NEW BRUNSWICK
Sydney
3
2
4
5
304
Quebec
12
11
8
SCOTIA
504
Shawinigan Falls
Fredricton
Three Rivers
9
6
Halifax
214
404
Sorel
13
14
10
7
NOVA
15
C.P.Ry.
Atlantic Ocean
Montreal
Contrecoeur
Beauharnois
B&M RR.
503
305
114
N.Y.C.RR.
212
Boston
211
210
213
209
New York
208
Philadelphia
207
Seven Islands to Philadelphia - 1312 miles
Seven Islands to Sparrows Point - 1453 miles
(Leaf Bay - Ungava Bay to Philadelphia 1154 miles)
MAJOR PROJECTS IN THE GREATER SEAWAY AREA
Legend
H9 Non-Metallic Mines
100 Metallic Mines
200 Iron Ore Consuming Regions
See Text for Detailed Legend
300 Aluminum Plants & Refineries
400 Non-Ferrous Smelters
500 Power Installations
0 25 75 100 200
Scale in Miles

Index to Major Bulk-Shipping Producers on Map

NONMETALLIC MINERALS

1. Atlantic Gypsum Ltd., gypsum
2. Dominion Coal Co. Ltd., coal
3. Bras D'Or Coal Co. Ltd., coal
   Old Sydney Collieries Ltd., coal
4. Little Narrows Gypsum Co. Ltd., gypsum
5. Acadia Coal Co. Ltd., coal
   Drummond Coal Ltd., coal
6. National Gypsum (Canada) Ltd., gypsum
7. National Gypsum (Canada) Ltd., gypsum
8. Cumberland Ry & Coal Co. Ltd., gypsum
   Indian Cove Coal Co., coal
   Joggins Coal Co., coal
9. Canadian Gypsum Co. Ltd., gypsum
10. Gypsum Lime & Alabastine Canada Ltd., gypsum
11. Canadian Gypsum Co. Ltd., gypsum
12. Avon Coal Co. Ltd., coal
    A. W. Wasson Ltd., coal
    D. W. & R. A. Mills Ltd., coal
    King Mining Co. Ltd., coal
    Miramichi Lumber Co. Ltd., coal
    Newcastle Coal Co. Ltd., coal
13. Quebec Asbestos Corp. Ltd., asbestos
14. Asbestos Corp. Ltd., asbestos
    Bell Asbestos Mines Ltd., asbestos
    Flintkote Mines Ltd., asbestos
    Johnson's Asbestos Co., asbestos
    Johnson's Co. Ltd., asbestos
15. Canadian Johns-Manville Co. Ltd., asbestos
    Nicolet Asbestos Mine Ltd., asbestos
16. Canadian Refractories Ltd., magnesitic dolomite
17. Gypsum Lime & Alabastine (Canada) Ltd., gypsum
18. Canadian Gypsum Co. Ltd., gypsum
19. Canadian Johns-Manville Co. Ltd., asbestos

IRON ORE DISTRICTS OR PRODUCERS

101. Fillmore County Iron District, iron ore
102. Baraboo Iron District, iron ore
103. Maryville Iron District, iron ore
104. Menominee Range, iron ore
105. Marquette Range, iron ore
106. Gogebic Range, iron ore
107. Mesabi Range, iron ore
108. Vermilion Range, iron ore
109. Canadian Charleston Ltd., iron ore
     Steep Rock Iron Mines Ltd., iron ore
110. Algoma Ore Properties Ltd., iron ore
111. Lowphos Ore Ltd., iron ore
112. International Nickel Co. of Canada Ltd., iron ore, nickel, copper and by products
113. Marmoraton Mining Co. Ltd., iron ore
114. Adirondacks Iron District, iron ore
115. Stelco Mines Quebec Ltd., (Hilton Mine), iron ore
116. Iron Ore Co. of Canada, iron ore
117. Quebec Iron & Titanium Corp., Iron, titanium dioxide slag
118. Dominion Wabana Ore Ltd., iron ore

MAJOR IRON ORE CONSUMING REGIONS (Shaded areas on map.)

201. Duluth District
202. Chicago-Gary District
203. Sault Ste. Marie District
204. Detroit-Cleveland-Buffalo District
205. Valley District
206. Pittsburgh District
207. Philadelphia District
208. Roebling District
209. Bridgeport District
210. Phillipsdale District
211. Everett District
212. Worcester District
213. Troy District
214. Sorel District
215. Port Colborne District
216. Hamilton District

ALUMINUM PLANTS AND REFINERIES (With output capacity.)

301. Canadian British Aluminium Co. Ltd., Baie Comeau, Que.:
     80,000 short tons (Dec 31, 1959)
302. Aluminium Co. of Canada, Arvida, Que.:
     362,000 short tons (Dec 31, 1959), 894,800 kw
303. Aluminium Co. of Canada, Isle Maligne, Que.:
     115,000 short tons (Dec 31, 1959), 402,680 kw
304. Aluminium Co. of Canada, Shawinigan Falls, Que.:
     68,000 short tons (Dec 31, 1959)
305. Aluminium Co. of Canada, Beauharnois, Que.:
     37,000 short tons (Dec 31, 1959)
     Dec. 31, 1959 estimates of tonnage by Canadian Dept of Mines and Surveys
306. Aluminium Co. of America, Massena: 112,250 short tons (Dec 31, 1957), 239,000 kw.
     Reynolds Metals Corp., Massena: 112,250 short tons (Dec 31, 1957), 239,000 kw.
     Dec. 31, 1957 statistics by USBM

MAJOR NONFERROUS SMELTERS

401. Noranda Mines Ltd., Noranda: Copper anodes
402. Falconbridge Nickel Mines Ltd., Copper Cliff, Ont.: Nickel, copper, gold, silver selenium, tellurium.
     International Nickel Co. of Canada, Sudbury, Ont.: Nickel, copper, gold, silver, selenium, tellurium.
403. International Nickel Co. of Canada, Port Colborne, Ont.: Nickel, cobalt
404. Quebec Iron & Titanium Corp., Sorel Que.: Titanium dioxide slag, iron.
405. Gaspe Copper Mines Ltd., Gaspe Peninsula, Que.: Copper.

MAJOR POWER INSTALLATIONS

501. Power Authority of New York, Niagara Falls, New York: 2-million kw
     Hydro-Electric Power Commission of Ontario, Niagara Falls, Canada: 1,252,900 kw
502. Power Authority of New York, Massena: 750,000 kw
     Hydro-Electric Power Commission of Ontario, Cornwall, Ont.: 750,000 kw
503. Hydro-Electric Power Commission of Ontario, Beauharnois, Ont.: 1,666,400 kw
504. Shawinigan Water & Power Co., Shawinigan Falls, Ont.: 246,100 kw
505. Aluminium Co. of Canada Ltd., Chute-A-Caron: 223,700 kw
506. Aluminium Co. of Canada Ltd., Chute-A-La Savane: 212,500 kw
507. Aluminium Co. of Canada Ltd., Chute Du-Diable: 205,100 kw
508. Manicouagan Power Co., Baie Comeau: 218,000 kw

---

is shipped to Escanaba, Mich. Gogebic ore is shipped to the lake port of Ashland, Wis. and the Cuyuna Range ships to Superior.

The 80 miles of iron properties on the Mesabi range, discovered by the Merritt brothers in 1890, ship the great bulk of their ore through the lake ports at Duluth and Two Harbors, Minn. and Superior, Wis.

In addition to these major ranges, ore from the iron region in Fillmore County, Minn. is shipped all-rail to consumer centers in the Middle West.

A part-rail shipper is the Michipicoten Range, northwest of Sault Ste. Marie. The ore is shipped to Sault Ste. Marie, Ont. and also to a lake port at Michipicoten Harbor on Lake Superior.

Ontario's Steep Rock mines, discovered in 1938 and operated continuously since 1945, ship to Port Arthur, Ont. on Lake Superior.

Labrador iron ore comes to port from the properties along the Labrador trough to Sept Iles (Seven Islands). Most of this ore goes to U.S. furnaces but some is exported to Europe. A 360-mile railway extends to Sept Iles. A second railway is being built. (E&MJ, March 1959, p 18.)

Cyrus Eaton interests have linked with European capital—Krupp of Germany—to funnel Ungava Bay ore, in which they have a mutual interest, to Europe with some ore possibly going to lake ports. The Danish government in 1958 accepted a proposal of Ungava Iron Ore Co. to build a transit harbor near Godthaab, Greenland, to handle ore shipments. From the stockpile, market shipments are to be made to European and U.S. east coast ports. Shipments will be made in 72,000-ton ore vessels when Ungava Bay is open (approximately five months of the year). The same vessels will be used during the balance of the year to transport ore from Greenland to Rotterdam, where

the concentrate will be unloaded and shipped to various German steel plants.

During the period that Ungava Bay is open to navigation, some ore will probably be shipped directly to European ports as well as to Atlantic ports without being trans-shipped in Greenland.

As the need for iron ore in the U.S. increases, the Seaway is expected to gain in importance as a shipping route to U.S. smelting centers utilizing Canadian and other foreign ore. Hematite production from the Mesabi and the other established iron ranges is expected to remain relatively constant for the next 30 years and taconite concentrates, although expected to increase, will not balance future needs for iron. Production from other northern, southern and western U.S. deposits are also expected to level out and remain relatively constant during the next 30 years. This means that the deficit must be filled either by Canadian ore or imports exclusive of Canada. In either case the Seaway will play a major role in the future iron ore trade.

Troubled Waters

Reports indicate that all-water Seaway shipping rates are high due to its seasonal nature, toll charges and the relatively small traffic. The lack of preferential rail rates to Seaway ports force some ore shipments to go by rails that might otherwise use the Seaway. According to John C. Beukama, president of the Great Lakes Harbors Association, St. Lawrence ports still have much to do in providing adequate port facilities and equipment for diverse cargo. Transportation routes to the more inaccessible mining regions have yet to be adequately defined, and until better methods of getting ore to port are developed, many mines will ship overland by rail and truck to milling and processing centers.

Referring to the competition, Arthur E. Baylis, a New York Central vice president, cited four ways in which the rails can compete with the Seaway:

1) Low rates during the Seaway's navigation season—on bulk commodities—but higher rates in winter.

2) Year-round rates made in contract with shippers who will agree to give railroads their business.

3) Spot adjustments covering a particular commodity from a particular spot.

4) Short-haul adjustments to lake ports. Once the railroads have lost the long haul to the Atlantic, they will want to keep the short haul to lake ports away from trucks.

Although the Seaway's new locks may cut the old lake turn-around time by three days, the Seaway trip will be six days or more longer than a combination overland and ocean haul.

Bulk facilities are located at all the lake ports, but whether they will prove to be adequate for the expected tonnages of bulk materials is yet to be determined. Several shipping authorities report that many ports are far better equipped to handle outgoing bulk cargo than they are for incoming equipment and general supplies for mines and mills in their regions. Also, general cargo rates are higher, a factor that must be considered when handling mine and mill equipment for new operations or when replacing old.

One problem immediately facing Seaway shippers is the annual freeze-up of lake ports during the winter.

This will cause a shifting of business patterns. And until the first winter on the Seaway comes, many authorities believe, these transportation patterns will not have been tested.

Some mining companies combat the winter problem by stockpiling until spring, with the resultant tie up of profits and increased storage costs.

Traffic Jams the Seaway

Within three weeks after opening (see E&MJ, May 1959, p 23) sailing on the Seaway was shown to be far from smooth. A half-dozen ships were damaged, and several dozen others were delayed.

The damages were "more irritating than serious," but the delays have been costly. A late thaw caused 60 ships to pile up at Montreal in five days, slowing passage up the St. Lawrence until traffic thinned out. At the Lake Ontario entrance to Canada's Welland Ship Canal, as many as 48 ships stacked up again while waiting on the single passage locks. In Detroit, where harbor berthing space was inadequate, ships had to wait in the Detroit River for their turns.

Delays can cost a shipper $750 to $1500 a day and slow down movement of goods. To avoid them, both shipping lines and shippers could go back to using Atlantic ports. On the other hand recent reports indicate that Seaway traffic jams are loosening up and priority systems are being established.

According to Jean-Claude Lessard, vice president of the St. Lawrence Seaway Authority of Canada, "Ships engaged exclusively in carrying commodities essential to Canadian and U.S. industry get 50% priority whenever an accumulation of six vessels occurs anywhere on the Welland Canal or the Seaway."

"Essential commodities" are coal, grain and iron ore. Fifty per cent priority means that any vessel loaded exclusively with any of the three commodities will proceed first and other ships similarly loaded will proceed alternately with general cargo vessels," he said.

Kilowatts For Growth

Seaway power is needed in Canada for the booming growth of industry in Ontario which is reported to be burning up nearly every kilowatt of power Ontario-Hydro's stations can produce.

On the U.S. side of the river, the power may make it possible for a hoped-for industrial growth in the rural northeast corner of New York.

One advantage New York will gain from state power will be its lower cost, according to the N.Y. State Power Authority. Lower costs may be passed on to the consumer if St. Lawrence power runs the estimated 25% less than past wholesale rates. Since transmission costs are expected to remain constant, the ultimate cost of electricity to the retail consumer in mine or home might run about 10% less than its cost from private utilities, the authority says.

Practically the total fall of more than 80 ft on the river between Prescott and Barnhart Island (see pp 82-83) is concentrated at the powerhouses constructed by the Hydro-Electric Power Commission and the Power Authority of New York, a short distance upstream from Cornwall. The water level has been raised by the Long Sault Dam and several coffer dams in the section to allow generation of some 1.57-million kw, submerging the old canals and creating a lake 25 miles upstream to Iroquois.

Power generation at Barnhart is an even split between the U.S. and Canada. The two plants, on either side of the Barnhart Power Dam, are expected to have an effective generating capacity of 1.5-million kw. Canada's share, on an energy basis, will amount to 6.5-billion kwh a year.

The most important benefit to Ontario of the St. Lawrence power—sought by the province for years but delayed through U.S. failure to agree until now—is that it has helped to stave off an otherwise inevitable expansion into high-cost steam power. Ontario-Hydro authorities estimate the cost of St. Lawrence power at about 4.17 mills per kwh, and that from coal-fired steam plants at about 7.5 mills.

Power in Ontario is publicly owned and operated by Ontario Hydro-Electric. Ontario Hydro maintains a 17,000-mile grid system, blanketing all of southern and part of northern Ontario, with emergency tie-lines with Michigan and New York.

Massena Means Metals

Arrival of this massive source of industrial power has guaranteed major changes for the once-quiet riverfront village of Massena. Reynolds Metals Co. has built an $88-million aluminum plant on the river bank a mile east of Massena which employs about 600 workers. The Reynolds plant has three pot lines with an estimated 100,000 tpy capacity, and began smelting July 9. Aluminum Company of America, which has provided the great bulk of local employment for five decades, has modernized and expanded its plant just north of the village. Alcoa presently employs 3,000 workers.

Chevrolet Div. of General Motors has built a $15-million plant designed to employ 700, hard by the Reynolds site, where it will share common docking facilities at the mouth of the major Seaway channel.

From the new St. Lawrence power station, Reynolds is drawing 200,000 kw, Alcoa 174,000 and General Motors 12,000. This is "firm" power available on a guaranteed year-round basis, no matter what the water level of the river.

In addition, Reynolds has contracted for 39,000 and Alcoa for 65,000 kw of "interruptible" power, that is, power which will be available when the water is high, but may not be in the slack water season.

From its beginnings on the towering plateau of Lake Superior, 600 ft above sea level, waters of the St. Lawrence drop over a distance of 2,000 miles to the sea (see pp. 82-83).

Vessels from the Atlantic enter the Seaway 30 miles below Quebec city in the St. Lawrence Ship Channel. The channel extends to Montreal. Above Montreal, at Sault St. Louis, are the Lachine Rapids which are by-passed by the St. Lambert Lock, raising the ship to the level of the Laprairie Basin Channel and the Cote Ste. Catherine Lock. Dikes have been built to protect the channel from ice and silting and keep it free from undesirable cross-currents. Adjacent to this area may lie the potential of a vast new industrial development. The Cote Ste. Catherine Lock lifts vessels to the level of the overland channel which carries them to Lake St. Louis, a great widening in the river.

At Beauharnois the Canadian Seaway Authority has constructed two locks to by-pass the Beauharnois Power Canal. Also at Beauharnois, Ontario Hydro-Electric is building a powerhouse planned for completion in 1961. It is expected to have a total installed capacity of 1,666,400 kw.

The Canadian and U.S. power authorities have also expanded their Niagara generating stations. New York Power Authority reported that it is spending $700-million for construction of generating facilities to produce 2-million kw. The Canadians have expanded their Sir Adam Beck-Niagara generating station designed to produce 1,252,900 kw.

At Iroquois the power authorities have constructed a control dam to regulate outflow from Lake Ontario. Shipping navigates this section by the Iroquois Canal and Lock. Wide and deep channels lead from the Iroquois Lock to Prescott. From Prescott to Lake Ontario, the Thousand Island section of the Seaway was dredged almost entirely by the U.S. St. Lawrence Seaway Development Corp., a total distance of over 68 miles.

To provide a by-pass for Niagara Falls and the requisite 27-ft depth throughout, the St. Lawrence Seaway Authority has deepened the Welland Ship Canal and its eight locks and widened the channel by dredging from the original 25 ft to the present 27 ft for some 27 miles. The Welland crosses the Niagara Peninsula 10 miles west of Niagara Falls and lifts vessels over 326 ft through eight 80-ft wide locks, seven that are 859-ft long and one which is 1,380-ft long.

Lake Ports Look Ahead

All of the major Canadian and U.S. lake ports are working on, or have finished improvements, and several have optimistic outlooks for the future. The hope is that they will be raised to the level of the great ocean ports of the world.

Chicago and Gary have completed new loading docks and other port facilities to handle the stepped up inflow of iron ore from the Labrador Trough and some optimists visualize a massive "Illiana Harbor" composed of docks along the lower portion of the lake where Indiana and Illinois join. Some predict that the region will become a world shipping center equal to the other great ports in the nation.

Detroit can anticipate over 300,000 tons of overseas cargo in 1959 due to the Seaway and about 1-million tons by 1965, it is estimated. Duluth has a new $10-million marine terminal, and Toledo and Cleveland plan expansion programs that will link shipping facilities with major railroads.

Montreal may be by-passed by shipping but the more optimistic view is that Montreal will become an even busier trans-shipment point. Toronto has great hopes for the Seaway. According to E. B. Griffith, general manager of the harbor commission, "Toronto could become the leading port on the Great Lakes for overseas shipping."

Hopeful Hamilton

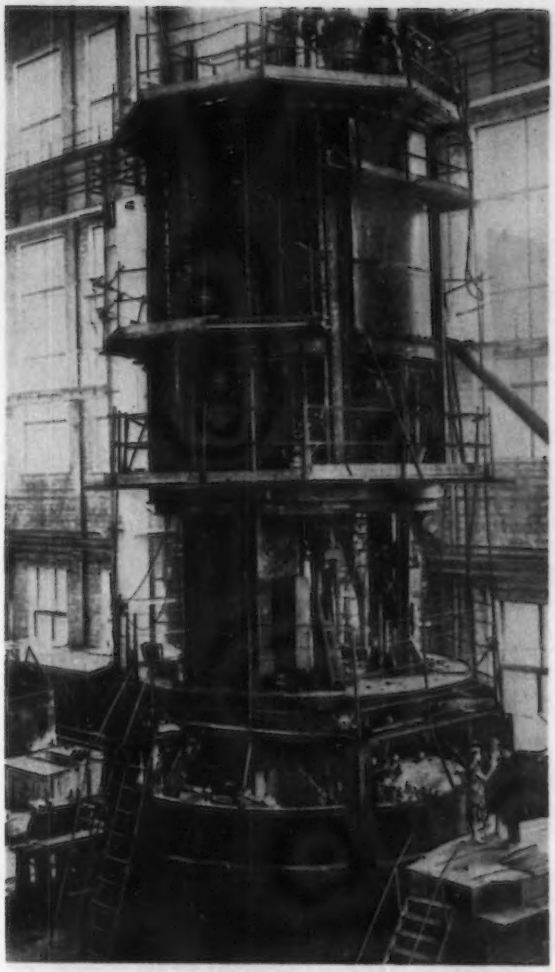
Hamilton has a 20-year plan for Seaway port expansion and is already the third largest harbor in terms of yearly tonnage of Canada's ports. Hamilton, too, expects to be a major trans-shipment area. Most of the iron ore for its two big steel mills still comes from the head of the lakes but an increasing amount may be coming down the Seaway from the new Quebec-Labrador mines.

Seven Islands has been growing with the Labrador iron ore shipments and may be one of Canada's best natural harbors. A new 900-ft pier has been built close by the 1,600-ft waterfront dock.

Prescott is near the western terminus of the St. Lawrence River, only 60 miles east of Lake Ontario. This community expects to become a busy deep-water port serving the Ottawa Valley and eastern Ontario.

References

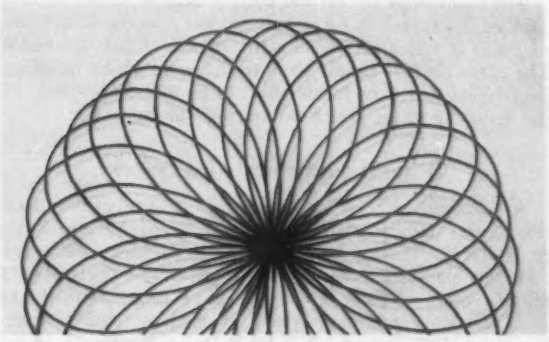
1. Archibald, R. S.: Economic History of the Lake Superior Iron District, 1959 Jackling Lecture.
2. THE NEW YORK TIMES. The St. Lawrence Seaway. Section II, June 29, 1958.
3. The St. Lawrence Seaway Authority. The St. Lawrence Seaway Under Construction. 1957.
4. Maritime Administration, U.S. Dept. of Commerce. Engineering Study of the Effects of the opening of the St. Lawrence Seaway on the Shipping Industry. 1958.
5. The St. Lawrence Seaway Authority Tolls Committee. Report. June 12, 1957.
6. Sufrin, Sydney C. & Palmer, Edward F. The New St. Lawrence Frontier, Maxwell School Series, Syracuse University, Syracuse, N.Y. 1957.
7. Chevier, The Hon. Lionel. The Seaway in the Canadian Economy. The Dalhousie Review, Autumn. Volume 36, No. 3.
8. The St. Lawrence Seaway (La Voie Maritime du St.-Laurent). The St. Lawrence Seaway Authority. Map.
9. General Plan of Great Lakes & St. Lawrence River. The St. Lawrence Seaway Authority. Map.
10. Great Lakes-St. Lawrence Seaway Projects. Saint Lawrence Seaway Development Corp. March 1958. Map.
11. Canada, Principal Mineral Areas. Compiled by the Canadian Dept. of Mines & Technical Surveys. Map 900A (Eighth Edit.).
12. Canadian Iron Ore & the North American Iron & Steel Industry. Compiled by the Canadian Dept. of Mines & Technical Surveys. Map M.R. 1.
13. St. Lawrence Seaway Information Folder compiled by the Canadian Consulate, N.Y., N.Y.



Rig Cost About $380,000 to Build

Weight of unit, overall, tons	135
Height of unit, overall, m	17.3
Diameter bored, m	7.3
final lined shaft, m	6.5
Sinking rate, designed, m per month	up to 180
Power, installed capacity, total, kw	615
cutter drive only, kw	370
pump drives only, kw	225
Rotational speed of entire head, rpm	1.9
Torque on head, kg	2,200
Rotational speed of disks, about own axis, rpm	0.9
Torque on disks, kg	15,000
Diameter of disk, m	3.7
Bit speed, at center, m per sec	1.74
at periphery, m per sec	1.02
Advance of head, nominal average, mm per minute	6.7
Size of muck produced, mm	up to 100

TWO 12-FT DISKS on Soviet PD-1m shaft borer act like huge polishing wheels, advancing 25-ft dia concave face at 1¼ fph in medium hard rock. Head also rotates; and bits, 20 per disk, cut complex pattern of grooves (below). Lands are broken-off and bucketline removes minus 4-in. muck to skip-loading bin. Concrete-panel lining is placed concurrently.



Soviet Shaft Borer Has Unique Head

B. SHAVKUN

DESIGNED for sinking deep vertical mine shafts of 6.5-meter finished diameter in stable medium-hard rock, the new Soviet Type PD-1m shaft borer provides integrated mechanization of all operations. It breaks the rock mechanically, loads the muck into hoisting skips and has apparatus for lining the shaft, pumping water, ventilating the working areas, lowering materials and performing other auxiliary operations.

For some time, Soviet mining engineers have been searching for new and more powerful methods and equipment to break and penetrate rock. Although core drilling has been successfully used to sink shafts fairly rapidly in medium-hard and hard rocks without any human labor in the shaft proper, the method does not lend itself to simultaneous sinking and lining. The Type PD-1m unit overcomes this problem and at the same time raises productivity and improves working conditions.

The complex unit was designed at Tsniipodzemshahtostroy under the direction of chief designers M. Shegolevsky and V. Grigoriev. It was manufactured at the Ural Machine Building Works through the efforts of a great number of designers, technologists and workers.

The borer has passed factory tests, including simulated operations on a block of concrete-grouted limestone boulders, and is presently being installed at the No. 122 Saranskaya mine in the Karaganda coal basin. At this mine, even though the shaft will be only 235 m deep, estimates indicate that sinking costs will be cut 20% and sinking time cut 30-50% as compared to conventional methods.

Further factory tests and manufacturing improvements have shown ways to simplify future assemblies and thereby reduce the weight from 135 tons to 80-90 tons, reduce the number of components 50-60% and reduce the cost of manufacturing from 3.8-million to 1- or 1.2-million rubles. [Ed.—Money experts in the U.S. suggest using an exchange rate of 10 rubles per dollar for comparison purposes.]

Unit Has Four Decks

The frame of the machine consists of four circular decks (number 3 in drawing) connected by columns and

Mr. Shavkun is chief of the information department of the Central Research Institute for Designing Underground and Mining Equipment, Moscow, USSR.

braces. The unit is moved vertically by eight 25-ton winches with ropes passing through the upper decks and attached to the lowermost deck by hydraulic jacks which equalize rope tension. Central control of all winches is provided and rapid lifting is available to prevent damage from water flooding or rock collapse. The machine is centered and held in working position by horizontal hydraulic pistons (7) and hydraulic jacks acting against longitudinal guide skis (15). In the longitudinal core of the frame are the working mechanisms with the cutting-loading head below the bottom deck.

The head of the machine consists of two cutting disks 3.7 meters in diameter (9) with reducing gear assemblies (10), and two bucket excavators (8). Each disk carries 20 hard-alloy-tipped cutting tools. The disks rotate around their own axes and at the same time around the axis of the shaft itself. Thus the tools move along hypocyloidal curves which intersect and from pyramidal islands on the spheric surface of the shaft bottom. These are sheared off when they reach a predetermined height.

Two bucket excavators mounted on the reducing gear boxes scoop up broken rock and transfer it through a stationary rock hopper (11) to a vertical elevator (12). From the vertical elevator the rock is dumped into bunkers (2) and then into 2.3-cubic m skips (1) for hoisting to surface.

The main drive (5) for the cutting head is on the second deck of the frame. It turns two vertical concentric splined-shafts (13) which are fed downward to advance the head. The outer shaft is rigidly fixed to the body of the reducing gear boxes (10). The inside shaft turns the solar wheels of the reducing gears which rotate the cutting disks.

Other Equipment Aids Work

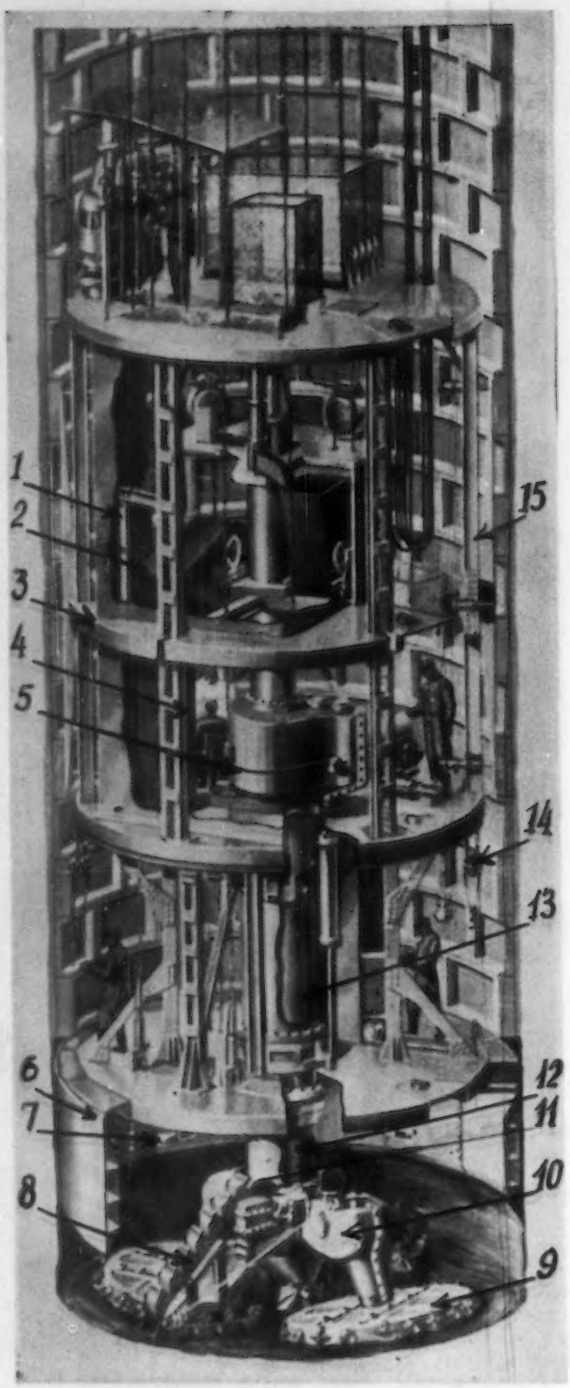
A sectional circular shield (6) below the bottom deck serves as a temporary shaft lining when sinking in loose rock. To set the permanent lining of precast reinforced concrete panels, there are two pneumatic hoists (14) moving on a circular monorail above the bottom deck.

A two stage pumping system is used to remove water from the shaft bottom. It is designed to handle up to 60 cubic m per hr. Water from the bottom is pumped to a sump tank by a hydraulic elevator placed inside the driving shafts, then it is raised to the surface or an intermediate recess by pressure pumps Type PPN-50-12.

All mechanisms of the unit are remotely controlled from a special control panel. Near the panel are instruments to indicate vertical alignment, position of the cutting disks with respect to the guiding device, and the rate of the cutting head advance.

Illumination of the working areas is provided by 24 lamps. Frame joints are waterproofed to exclude any water seepage. And effective communication between control panel and operating crew is furnished by speaking tubes; and to surface, by telephone and electric signal equipment. Materials and men are transported by cage.

The machine is attended by an eight-man crew including an operator, an electrician, a cageman, a skip-tender, a pumpman and three men setting lining.



SOVIET SINKING STAGE is designed to provide simultaneous mechanical breaking and mucking and lining placement.

Tests Prove Successful

By the end of 1958 the unit had passed factory tests and tests began on its working capacity.

A special test stand and a block of artificial rock was used for the working tests (see lead photo). Essentially the artificial rock was concrete having a limestone content of over 90% both as lumps of 300-500 mm size and crushed sizes 200-250 mm. The Ural limestone used contains dolomite inclusions and has a compressive strength of 1,040-1,370 kg per sq cm. Water was directed continuously across the face at different rates, and 5-6 cubic m of clay were added.

During the test all mechanisms worked satisfactorily. Penetration rate of the cutting head was 4 to 8 mm per minute. For cutting one cubic m of rock, 7.5 to 10.5 kw of power was supplied and overall power consumption did not exceed 150-200 kw.

The Price of Copper, 1960-1975

FOUR YEARS AGO, in August 1955, the price of copper averaged 38.45 c per lb in U.S. (Connecticut Valley) and 46.43 c (U.S. equivalent) on the London Metal Exchange. The U.S. price subsequently rose to an average of 47.03 c and the London price to an average of 52.50 c in March 1956. Analysis of the long-term trends in evidence in copper requirements, copper supplies, and the cost of copper production indicated (August 1955) that, during the period 1955-1975, a demand-supply balance could be maintained at an average world price of 30 c per lb, which would provide adequate profits for most copper producers.

In March 1958 the U. S. price averaged 24.42 c and the London price 21.27 c per lb. During the 46 months, August 1955 through May 1959, the U. S. price has averaged 33.64 c and the London price 32.70c per lb.

Despite much talk of inflation and rising costs of production, the statistical record of the past four years has offered no evidence which warrants expectation of any other average price than 30 c per lb for the period 1960-1975. Known sources of supply seem adequate to meet both present demand and such demand as is likely to arise in the foreseeable future. At the 30 c average price level, producers generally will continue to enjoy good profit margins.

Prospective industrial requirements of copper based on long-term trends in evidence since 1912 are on the order of:

	(Thousands of short tons)		
	Actual 1958	Est. 1959	Est. 1975
U.S.	1,285	1,450	2,000
World	4,318	4,650	5,000

During the past two years, and as estimated for 1959, the U. S. and World copper positions are given in Table 1.

During the 46 year period 1913-1958 production and use of copper has been about as indicated in Table 2.

The adequacy of known sources of supply to meet prospective future demands for copper must be gaged not only in terms of mine productive capacity but also in terms of potential supplies of secondary copper. In the accompanying tabulation it may be seen that the world has absorbed nearly 116-million tons of copper in various industrial uses during the past 46 years. Between 60% and 75% of copper used in industry is reckoned to be eventually recoverable for reuse, either as unalloyed copper or in copper alloys and copper-containing chemicals. (Throughout this article the term "secondary copper" refers to unalloyed copper recovered from secondary materials, which in U.S. in recent years has averaged about 250,000 tons and about 780,000 tons for the world as a whole. A much larger tonnage contained in secondary brass, bronze and other copper-base alloys, not being identifiable as copper, is not included in the data in this article.) An addition of approximately 70-million short tons to the world's permanent reserve of copper is therefore indicated, over and above recoverable copper contained in underground reserves not yet mined. This does not mean that all 70-million tons will be available at any one time for re-use. It merely indicates the magnitude of copper now in use from which secondary copper may be drawn as required. See Table 3 showing world and U.S. absorption of copper.

WILLIAM P. SHEA

The figures in Table 3 are of interest because they show that the U.S., comprising 7% of the world's population, is absorbing over 40% of the world's entire production of copper. There is thus pointed up the assurance of a continuing expansion of world copper consumption as the other 93% of the world's population raises its standards of living and becomes more "copper-minded" than heretofore.

There is no doubt as to Russia's emergence as a formidably industrialized nation. China has announced long-term plans for development patterned along the lines of Russia's five-year plans. India and Indonesia both have ambitious industrial development programs under way. Among Latin American countries, Mexico, Brazil and Argentina are fostering both power development and industrialization.

All of these programs will require copper, and however humble their beginnings or slow their growth, their application to such a large proportion of the world's population indicates

Table 1. U.S. and World Copper Positions, 1957-1959

(Thousands of Short Tons)

	U. S.			World		
	1957	1958	Est. 1959	1957	1958	Est. 1959
Production						
Mine	1,093	980	1,100	3,867	3,600	3,850
Secondary	239	227	230	786	752	750
Total production	1,332	1,107	1,330	4,653	4,352	4,600
Net imports	232	95	138	...	...	...
Total production & imports	1,564	1,202	1,468	4,653	4,352	4,600
Distribution:						
To industrial use	1,404	1,285	1,450	4,566	4,318	4,550
To refinery stocks	+ 62	− 100	+ 6 (Mar.)	+ 87	− 199	
To fabricators stocks	− 7	+ 17	+ 12 (Feb.)			
Unaccounted for (by difference)	105				233	50
Total distribution	1,564	1,202	1,468	4,653	4,352	4,600

Mr. Shea is statistician for C. Tennant, Sons & Co., New York. In a previous article, "The Price of Copper, 1955-1975," E&MJ, August 1955, Mr. Shea made this statement. "The long-term price of copper should average about 30c per lb with only temporary deviations therefrom." This article represents a reappraisal of the copper price outlook.

Table 2. World and U.S. Production and Use of Copper, 1913-1958

(Thousands of Short Tons)

	U. S.	World
Production		
Mine	35,392	96,549
Secondary	8,409	21,489
Total production	43,801	118,038
Net imports, etc.	1,690	
Requirements:		
Used in industry	44,378	115,942
Increase in refinery stocks	28*	167*
To Government stocks	1,085	1,085
Production unaccounted for		844
Total requirements	45,491	118,038
*Refinery stocks		
12/31/12	53 (visible)	92
12/31/58	81	259

increasing requirements for the world's suppliers of copper to meet.

During the first part of the period, before 1940, the U.S. accounted for about half of the world's total production and was not only the largest user of copper but also an important exporter.

During World War II (1940-45) despite Government premium payments, U. S. mines and secondary sources accounted for only about one-third of the world's production of copper. On the other hand, as the "arsenal of democracy," U.S. absorbed nearly 50% of the world's production. It was during these war years that the U.S. position changed from that of traditional exporter on balance to that of importer in large volume. U.S. mine production failed by a wide margin to keep pace with the extraordinary expansion of U.S. copper requirements.

Since 1946, U.S. has accounted for 24% of world production but has absorbed (including stockpile) 41.5% of world production. U.S. mine and secondary production has remained in the range of about 1,100,000 tons to 1,400,000 tons per year, while U.S. industrial requirements have averaged above 1,454,000 tons.

While U.S. currently requires upwards of 40% of total world production to meet its industrial demands, extraordinary expansion of demand since pre-War II is apparent in other sections of the world. Since some of these expansions started from very modest beginnings, the actual tonnages involved do not as yet bulk large in world figures. Nevertheless, the percentages of increase are in many cases noteworthy. (See Table 4 showing industrial use of copper, including secondary, by country or area.) In the case of Western Europe, allowance should be made for the greater impact of war damage during the period 1940-1945 than in other parts of the world. Actually in the post-war period, 1946-1950, Western Europe's consumption of copper was only about 600,000 tons and consumption since that period has more than doubled.

Table 3. U.S. and World Absorption of Copper, 1913-1958

(Thousands of Short Tons)

	Production (incl. secondary)			
	World	U.S.	U.S. absorption	Percent of World production absorbed by U.S.
1913–39	51,495	25,586	19,754	38.4%
1940–45	18,792	6,672	9,150	48.7%
1946–58	48,108	11,762	19,988	41.5%

Chart I shows the annual industrial use of copper in U.S. (1900-to 1958) and throughout the world (1913 to 1958) together with the long-term trend lines in evidence for each. Projection of these trends into the future indicates for the U.S. annual use of copper of about 2-million short tons by 1975 and for the world a total of about 5-million short tons by 1975. Both figures include secondary copper. These projections are not intended to serve as estimates of the amounts of copper that will be required in any one year between now and 1975, but to point out the median lines about which annual data may be expected to fluctuate.

Table 5 shows the world's industrial use of copper by countries and by periods from 1913. These figures include secondary copper, actual for U.S., estimated for countries outside U.S.

Table 4. Industrial Use of Copper Including Secondary

(Thousands of short tons)

	Average 1936–1939	1958	Increase
Latin America	10	80	700%
India	10	64	540%
South Africa	5	28	460%
Canada	55	122	122%
U.S.S.R. & Satellites	289	546	89%
U. S.	757	1,285	70%
Western Europe	827	1,268	53%

Table 6 shows the world's mine production of copper by countries from 1913. The entire period of 46 years is divided into significant subperiods, as follows:

1913-1914	Pre-War I
1915-1918	War I
1919-1921	Post War I Depression
1922-1924	Recovery
1925-1929	Boom
1930-1935	Depression
1936-1939	Pre-War II
1940-1945	War II
1946-1950	Interbellum
1951 and following	Korea and "Cold War"

To meet the world's demand for copper, the mines of the world have

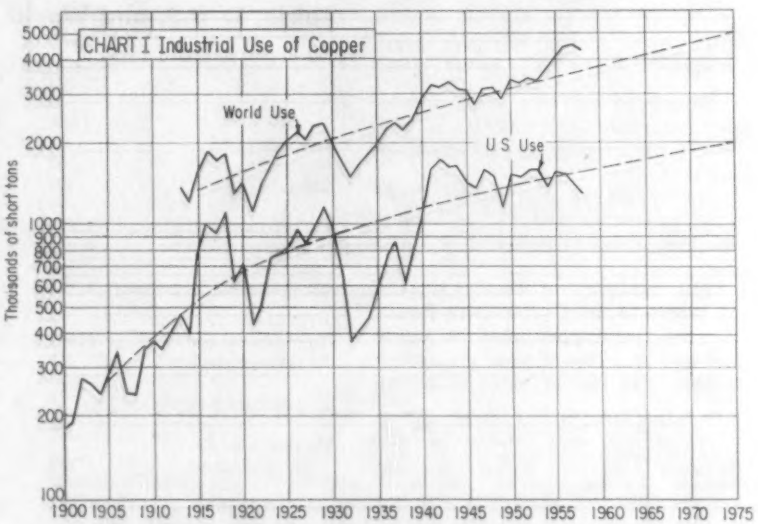


Table 5. World Industrial Use of Copper

(Thousands of short tons) May 1959

	Av. 1913–14	Av. 1915–18	Av. 1919–21	Av. 1922–24	Av. 1925–29	Av. 1930–35	Av. 1936–39	Av. 1940–45	Av. 1946–50	Av. 1951–55	1956	1957	1958
U.S.A. (incl. secondary)	437	959	588	681	953	574	757	1,525	1,422	1,513	1,539	1,404	1,285
Latin America	5	5	5	7	8	4	10	26	50	70	60	77	E. 80
British Commonwealth													
U.K.**	171	241	98	104	161	184	306	459	376	435	562	568	599
Canada	24	48	36	13	18	31	55	128	101	123	145	128	122
Australia-New Zealand	13	13	8	9	10	7	17	74	23	39	34	41	66
India	10	4	6	15	10	6	10	28	28	27	37	52	64
South Africa	3	5	3	3	4	3	5	15	8	20	25	34	28
Others													
Total Brit. Commonwealth	221	311	151	144	203	231	393	704	536	644	803	823	879
West Europe	448	329	237	371	575	509	690	400	499	771	1,025	1,119	E.1,016
Japan	28	45	85	77	85	100	201	120	53	110	163	194	E. 176
Other Asia ex-Brit. Comm.	9	3	5	16	11	5	9	15	2	2	1	..	..
U.S.S.R. & Satellites	47	61	11	20	58	102	243	190	232	364	458	509	E. 462
Secondary not incl. above estimated*	139	195	221	245	227	230	228	187	255	287	420	440	420
World Total	1,334	1,908	1,303	1,561	2,120	1,755	2,531	3,167	3,049	3,577	4,469	4,566	4,318

*Estimated on the basis that use of secondary copper throughout the world bears the same percentage relationship to use of primary copper as it does in USA and UK combined. **Includes secondary from 1942

E - Estimated

Table 6. World Mine Production of Copper*

(Thousands of short tons) May 1959

	1913–14	1915–18	1919–21	1922–24	1925–29	1930–35	1936–39	1940–45	1946–50	1951–55	1956	1957	1958
U. S. A.	597	916	502	672	887	391	680	959	780	935	1,114	1,093	980
Latin America	133	207	188	297	418	329	478	623	558	555	672	685	E. 639
British Commonwealth													
Canada-New Foundland	38	55	34	38	82	160	274	298	258	283	355	361	347
Rhodesia-So. Africa	12	14	10	15	20	116	230	286	298	450	522	559	525
Australia	46	44	23	17	13	17	23	26	17	33	55	58	76
India-Burma	..	..	..	..	3	13	11	7	7	7	9	9	9
Cyprus and others	..	..	..	..	2	6	30	3	17	25	39	44	58
Total Brit. Commonwealth	96	113	67	70	120	312	568	620	597	798	980	1,031	1,015
Africa ex-Brit. Comm.	10	18	20	69	94	110	136	176	170	238	283	282	267
Asia ex-Brit. Comm.	75	104	75	67	76	81	95	83	39	86	128	148	140
West Europe	117	118	76	102	133	148	164	118	127	146	154	163	154
U. S. S. R. & Satellites	32	17	5	3	18	44	118	158	223	348	417	465	465
World Total Mine Prod.	1,060	1,493	933	1,280	1,746	1,415	2,239	2,737	2,494	3,106	3,748	3,867	E.3,600
Secondary Production													
U. S. A.	75	105	119	132	223	210	222	129	247	219	273	239	227
Rest of World—est.	139	195	221	245	227	230	228	241	459	384	537	547	525
Total Secondary—est.	214	300	340	377	450	440	450	370	706	603	810	786	752
World Total Production	1,274	1,793	1,273	1,657	2,196	1,855	2,689	3,107	3,200	3,709	4,558	4,653	4,352

*Figures for 1913 through 1955 are yearly averages for periods shown.

more than tripled production during the period shown. The most noteworthy increases have come from countries listed in Table 7.

These six countries have accounted for 2,326,000 of the 2,540,000 tons of increase in copper mine production.

Based on present prospects for both demand and supply, a reasonable expectation is that they will remain fairly well in balance over the next 15 years.

Chart II shows a combination of the Index of Industrial Production (Federal Reserve Board) and the Index of Wholesale Prices (Bureau of Labor). Both are taken at 1947-49 equal to 100. They are combined in order to obtain an index of the dollar value of commodities flowing into industrial use. This combined Index is compared with the annual volume of copper flowing into industrial use within the U. S. multiplied by the annual average price of copper. The two lines show a high degree of correlation.

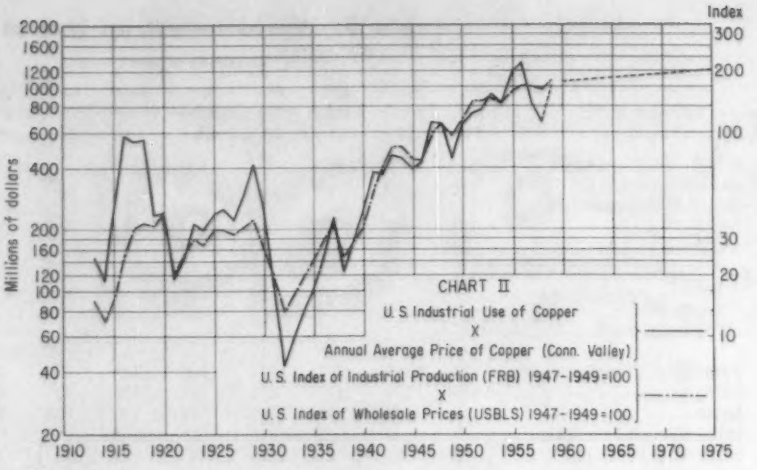
It is apparent that the volume-price of copper was out of line with the volume-price of other commodities during World War I and again during the 1923-1929 period. In each case the resulting correction of the volume-price of copper was thorough. During the 1932-1936 period the volume-price of copper was too low. Since 1937 the two lines have been reasonably close in their fluctuations.

The trend of the two lines has been sharply upward since the beginning of World War II, a period of only 20 years on which it would be hazardous to base a long-term projection into the future. However, in

Table 7. Major World Sources of Copper

(Thousands of short tons)

	Mine production		Increase in annual rate
	1913	1958	during 46 years
Rhodesia	12	525	513
Chile.....	42	478	436
U.S.S.R. & Satellites	32	465	433
U. S.....	597	980	383
Canada...	38	347	309
Belgian Congo..	10	262	252



the face of continuing inflation, attainment of a level of about 200 for the Industrial Production-Commodity Price Index by 1975 would seem to be a reasonably conservative assumption. At this level, the annual copper cost for U. S. industry would be about $1.2-billion. Industrial use of copper in the U. S. (Chart I) is expected to be about 2-million tons a year.

If we assume that the volume-price of copper will continue its present correlation with the Industrial Production-Wholesale Price Index, and the long-term trend of industrial use of copper in evidence since 1900 will continue, then the expectable price of copper in U. S. in 1975 would be 30 c per lb. in terms of today's value of the American dollar.

For 1959, U. S. industrial use of copper is estimated at 1,450,000 tons. At an average price (est.) of 31.165 c per lb, the volume-price of copper will be $1-billion corresponding to 180 on the Index scale.

Heretofore in this article all basic data employed has been published information. From this have been derived long-term trends leading to estimations of future probabilities, i.e., that the world demand and supply of copper will be in approximate balance during the foreseeable future; that U. S. industrial consumption will attain 2-million short tons by 1975, and the world as a whole 5-million short tons; and that these tonnages will be made available at an average world price of 30 c per lb. There remains to be determined whether a price of 30 c per lb will be adequate to cover costs of production and at the same time to provide reasonable profits for investors in copper-producing enterprises.

Copper companies, as a rule, do not make public their per pound costs of production. In U. S. the large copper producers incidentally produce other metals such as gold, silver, zinc, molybdenite, etc.; and at the same time they are the largest fabricators of copper.

Table 8 is derived from the published annual reports of seven copper mining companies which in 1958 accounted for 31.38% of the world's mine production, including U.S.S.R. and satellite countries. We have tried to eliminate fabricating activities from the income accounts of the companies concerned. Thereafter total cost is calculated to be the difference between the average market price of copper received by each company in any given year and the net income of the company per pound of copper produced during that year. That is, it is the total cost for each company of extracting a pound of copper from its ore reserves and getting it to market in finished form.

(*Continued on p 118*)

Table 8. Cost Per Pound—Five Year Moving Averages of Some Leading Copper Producers

(Cents per lb., U.S. equivalent)

		1949–53	1950–54	1951–55	1952–56	1953–57	1954–58	1958 Copper production—Thousand lb
Kennecott.....	Before taxes	11.103	12.037	13.078	14.475	15.862	16.346	637,464
	After taxes	16.779	18.319	20.685	23.169	24.314	24.216	
Phelps Dodge.....	Before taxes	12.240	13.460	14.600	15.810	16.230	15.690	437,148
	After taxes	17.140	18.920	21.010	23.020	23.540	22.840	
Greene Cananea....	Before taxes	17.659	19.307	21.429	24.824	NA	NA	61,188
	After taxes	19.899	21.674	24.449	27.959	NA	NA	
Andes Copper.....	Before taxes	19.976	20.975	22.536	23.689	E 24.162	E 23.697	71,962
	After taxes	21.334	22.225	24.763	27.430	E 28.590	E 28.395	
Chile Copper Co....	Before taxes	14.497	15.375	15.969	16.780	E 17.115	E 16.977	469,198
	After taxes	18.737	19.695	21.961	24.134	E 25.154	E 24.983	
Braden.....	Before taxes	16.315	17.318	18.004	18.885	19.262	19.107	383,156
	After taxes	19.183	20.247	21.933	24.039	25.045	24.874	
Mufulira.....	Before taxes	12.186	13.198	14.987	17.393	18.773	18.636	199,017
	After taxes	19.141	19.949	22.058	24.518	25.127	24.076	
Average:.....	Before taxes	14.854	15.953	17.229	18.837	18.567	18.409	
	After taxes	18.888	20.147	22.408	24.894	25.295	24.897	

NA—not available
E —estimated

Total, 7 companies	2,259,133
Total World, incl. U. S. S. R.	7,200,000
Percentage of World Total	31.38%

Gold Plants of the Future—Lessons From Uranium

ROBERT H. RARING
G. Y. MURRAY

MANPOWER CHART

JOB	SHIFT		
	1	2	3
CRUSHERMEN	2	-	-
GRINDING	1	1	1
LEACH & AGIT.	2	2	2
PPT & SOL	1	1	1
REPAIR	2	-	-
LABORATORY	2	-	-
METALLURGIST	1	-	-
SUPT.	1	-	-
TOTAL	12	4	4

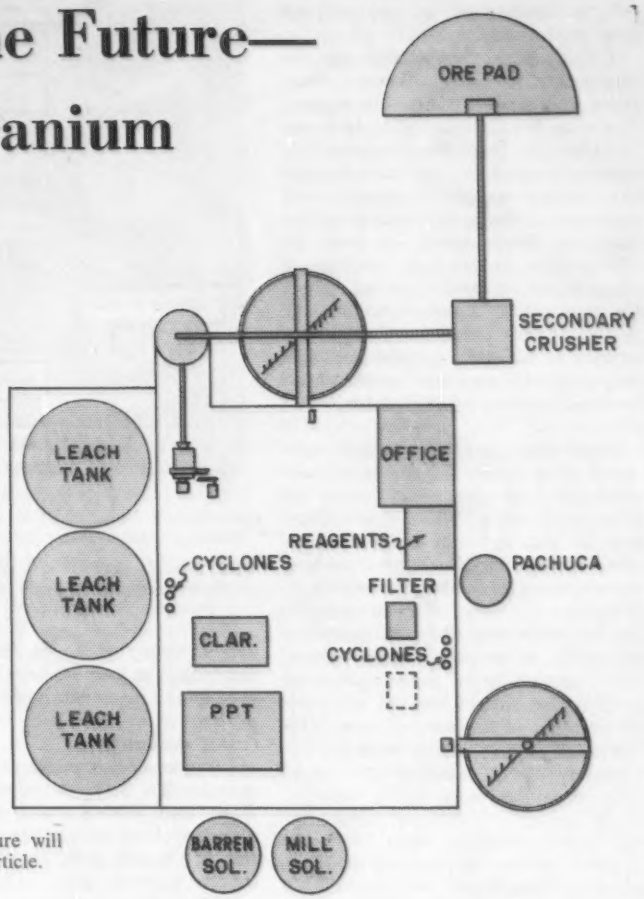


FIG. NO. 1.—the hypothetical gold plant of the future will look like this, as described by the authors in the article.

Robert H. Raring

G. Y. Murray

"Uranium processing in its infancy drew heavily on gold cyanidation practices; now the trend has reversed with uranium technology having much to offer the gold mill of the future."

MUCH HAS BEEN MADE—and properly so—of the hydrometallurgical technologies developed for the extraction of uranium from its ores. Under the stimulus of all-out effort, processes involving acid and alkaline leach circuits combined with solvent extraction, ion exchange or caustic precipitation have been brought to a high degree of perfection. Refinement is continuing and the end is nowhere in sight.

Like uranium, the extractive metallurgy of gold is hydrometallurgical, and in this respect, these two metals have a close degree of kinship. In fact, it can be said that every uranium plan bears the stamp of some tried-and-true tools and techniques that were developed by, and for the gold metallurgist.

A few examples will suffice to illustrate this close relationship. Take first the case of the pachuca agitator, widely used for agitation of uranium pulps.

The pachuca started out in New Zealand as the Brown agitator where it was developed for cyaniding gold ores. Later brought to Mexico, it was put to work on silver and there it picked up its well-known name. Today—its design up-dated by the demands of uranium—the pachuca, model 1959, is a highly efficient pneumatic agitator. The pachucas shown at Phillips Petroleum's uranium plant are 22-ft 6-in. dia by 54-ft high and hold 1,520 tons of 50% solids pulp. (See Fig. No. 13.)

In addition, a list of other items of gold processing equipment that have been applied to uranium extraction would look like this:

Mechanical agitators, thickeners, diaphragm pumps, countercurrent washing, drum filters, plate and frame filter presses, and leaf clarifiers

What it all boils down to is this: In developing his processes and techniques, the uranium metallurgist has drawn heavily on the experiences gained in the hydrometallurgy of hundreds of millions of tons of gold ores, and in so doing he has incurred a debt to the gold metallurgist.

Since turnabout is fair play, the gold metallurgist should have rightful interest in the tricks of the uranium trade. Our purpose here is therefore twofold:

1. To review those aspects of uranium processing which can advantageously be adapted to gold processing.

2. To appraise the effect of such

Mr. Raring is project manager and Mr. Murray is business development manager for Western-Knapp Engineering Co., San Francisco, Calif. The article was originally presented at the 1959 National Western Mining Association meeting and is reproduced here with permission of the Colorado Mining Association.

reverse "lend-lease" on the cost of gold production.

Let us begin by considering the elements of a straight-forward flowsheet employing a sand-slime separation (Fig. No. 2). As variously modified to suit individual ores and/or tonnage limitations, this basic operating scheme covers a pretty broad segment of the gold cyanide plants that once flourished in our land. By taking this pattern and putting it alongside a modern uranium plant, we can get a comparison of gold versus uranium practice. Thus, the dynamics of uranium metallurgical advances can be evaluated on the slower-paced practice of gold plants.

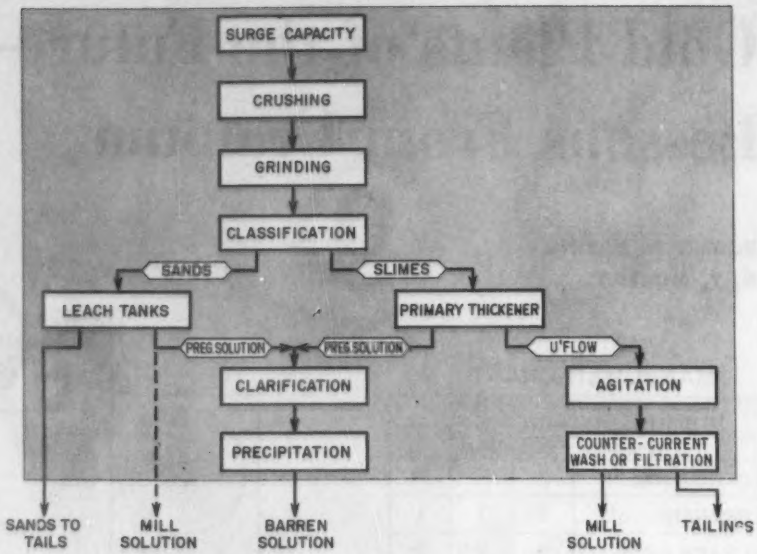


FIG. NO. 2.—generalized sand-slime flowsheet could be from either a gold or a uranium operation; yet this is more typical of old gold than a modern uranium mill.

Surge Capacity: It is almost universal in uranium to provide moderately sized surge capacity ahead of primary crushing. While this storage initially was and still is intended to allow segregation of ores by types and thereby permit blending of mill feed, it has the collateral effect of smoothing out both mine and mill operating schedules. It permits higher mining rates, use of larger mine equipment units and it should bar the necessity of overtime in the mining cycle. The net result is that mining costs are reduced by the cumulative economies. The surge pile is a buffer between mine and mill, protecting each from the vagrancies of the other. As such, it earns a place in planning the gold plant of tomorrow.

Loading from the surge pile can be done by front-end loaders or the ore can be pushed by a bulldozer. The location of the surge pile and the arrangement of hopper for the primary crusher should be such that the surge ore is not reloaded into trucks. Surge ore should be pushed—not lifted.

Use Surge Bins or Piles

The necessity for large expensive coarse ore bins is, of course, removed when surge capacity is provided. Where the mine source is an open pit, trucks should dump directly into the hopper and a surge should be built up to carry over week-ends or to safeguard against mine breakdowns. Conversely, the surge pile allows mining to proceed during mill outages for reline jobs, conveyor or crusher repairs, etc.

Crushing: Uranium plants tonnages are such that two-stage crushing is the rule, invariably with a jaw crusher for primary reduction. The generally soft character of most uranium ores has encouraged installation of impactor type reduction crushers. Scalping ahead of the primary crusher and screening ahead of second stage crushing is in keeping with established principles. In general, final crusher product is in the ¾-in. range, open circuit produced.

Circular steel bins are used for fine ore storage, with diameters held 20 ft or less. Where multiple bins are required, they are arranged as one side of the mill building proper, with suitable housing over the top to protect the delivering conveyor and its tripper. For rule of thumb, fine ore storage adequate for a 24-hour mill run is about optimum. Greater storage is extravagant while smaller capacities risk the danger of split crushing shifts, which is wasteful of manpower.

Grinding: The generally soft nature of the majority of continental uranium ores has relegated the grinding circuit to a relatively minor position. In many cases, especially notable with some of the Gas Hills ores, grinding is actually an attrition process whereby individual silica grain particles are abraded free of a coating of secondary uranium minerals. Naturally, in such cases, the accepted capacities of ball mills are far exceeded by mill throughput in actual practice.

This trend towards coarser finished grinds was discernible in two gold plants that were among the last to be built prior to World War II. We refer to the London Extensions Goldacres operation south of Beowawe, Nev. and the Standard Cyanide Plant near Lovelock, Nev.

In both cases, ball mill discharge is given a rough sizing by a trommel or screen, with tramp oversize being returned for regrind. The relatively coarse through-product is split into sand-slime fractions, the former for a percolation leach and the latter to conventional agitation.

Overgrinding Is Cardinal Sin

Costs realized at both the plants are the best recommendation for this practice in those cases where the ore is amenable to a sand-slime split. Overgrinding is a cardinal sin in any mill and it behooves the gold metallurgist to be doubly careful of his kilowatt-hours.

With those ores where fine grinding is a must, the trend to stage grinding with a rod mill-ball mill combination will effect operating economies in tonnages of 500 tpd and upwards. Depending on the particular ore, rod mill discharge will be in the range of 8 to 10 mesh. Classification is inter-stage, the rod mill in open circuit with the ball mill having classifier sands as its feed. This practice is diagrammatically shown on Fig. 3. It is hardly necessary to add that power is saved and danger of overgrinding held to a minimum when this circuit is employed.

The use of audio sensing and other types of instrumentation on feed and grinding control is increasing with claims of grinding capacity increases in range of 10%. This saving is compounded by a saving in manpower when mill performance is monitored by automatic means. Gold mills of the future must employ these tools in grinding circuits for, as we all know, it is in grinding that the kilowatt hours are used.

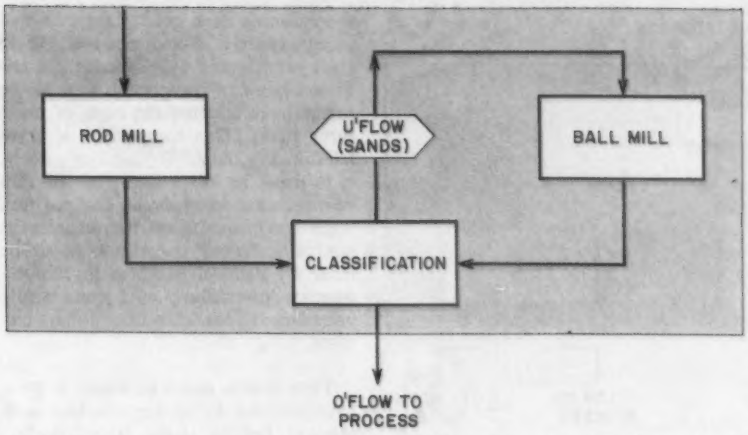


FIG. NO. 3.—stage grinding reduces power requirements and holds the danger of overgrinding to a minimum—overgrinding is a cardinal sin in any milling plant.

Classification: Nowhere in future gold plants will change be more apparent than in classification, where the wide acceptance of hydrocyclones is working a revolution. In the space of a little over 10 years, cyclones have established themselves as an invaluable tool, highly flexible, widely adaptable, and virtually trouble-free.

Cyclones can be used as the classifying element in closed circuit grinding or to make a sand-slime split of a finished pulp, ahead of leaching and agitation. They fit very well into washing-filtering circuits, splitting pulps between filters and thickeners. They are useful in tailing disposal. By requiring small space and being adaptable to wide arrangement, they will give the mill designer more latitude in his layouts, reduce floor space and thereby cut building costs.

In its modern version with moulded rubber lining and ceramic or silicon carbide apex, the cyclone will give long trouble-free service. A cyclone feed pump should be rubber lined, amply sized and the feed line should preferably be rubber-lined pipe. While power requirements for cyclone classification is greater than for rake or spiral classifiers, this drawback is more apparent than real when balanced against the advantages offered by cyclone installations.

There will be applications where stage classification is indicated, with cyclones to classify overflow of the conventional classifier. An installation of this sort could be resorted to in special situations that formerly employed bowl classifiers in fine grinding circuits.

In short, future gold mills are going to look a lot different because of improvement in cyclone design and developments in cyclone classification.

Agitation: Starting with Elsner's Equation, when the importance of free oxygen in gold dissolution was recognized, some means had to be devised to introduce air to agitation circuits. Air-mechanical types have had wide acceptance in pre-war gold plants but the improved pachuca design earns it a hard look from the gold metallurgists.

For one thing, modern pachucas have comparatively large capacities which can be equated, in single or multiple units, against required retention time. Agitation can be controlled by adjusting air pressure and volume. A pachuca is a self-contained vessel which can be arranged outside a building; it can be jacketed with insulation and even low pressure steam introduced to maintain uniform pulp temperatures if such is necessary during the winter. Pachucas require very little attention and lend themselves to a high degree of instrumentation and automatic control.

Along with the rejuvenated pachuca, some interesting published Russian data credit high gold dissolution rates in pulps agitated in modified flotation cells. The suggestion is that dissolution rate increases faster than the increased power-air input would indicate. If such tests stand up, the door is opened to the employment of a "high intensity agitator," a unit finding wide acceptance as a conditioner in copper flotation practice. This new type mechanical-air agitator, shown in Fig. 5, would naturally reduce space requirements and would arrange and look much like a battery of flotation cells. The number of these high intensity agitators required would, of course, be a function of retention time, a factor which would have to be established for each individual ore.

In any event, the agitator circuits of future gold plants are going to be strikingly different from pre-war conceptions of what constituted good practice in gold dissolution. Whether selection goes to the new pachuca or the super-agitator will depend on individual ore requirements. In either case, the net result is a distinct advance in the cyanide practice.

Thickening and filtration: While thickeners have changed but little, there is wide use of flocculants, such as Separan and Superfloc 16, in accelerating thickening rates and thereby reducing thickener sizes.

Filters have been refined with the

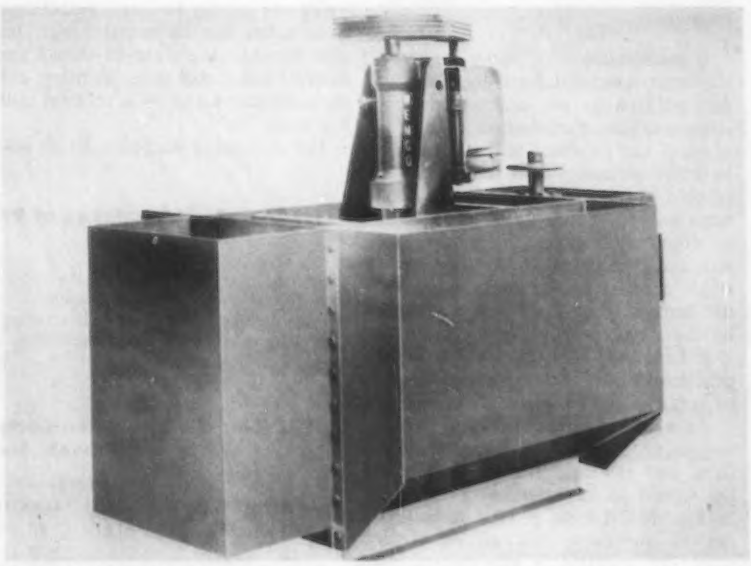


FIG. NO. 5.—"high intensity" or "super" agitators can be used in place of pachucas to cut down space requirements. Soviet mill men use flotation cells as dissolvers.

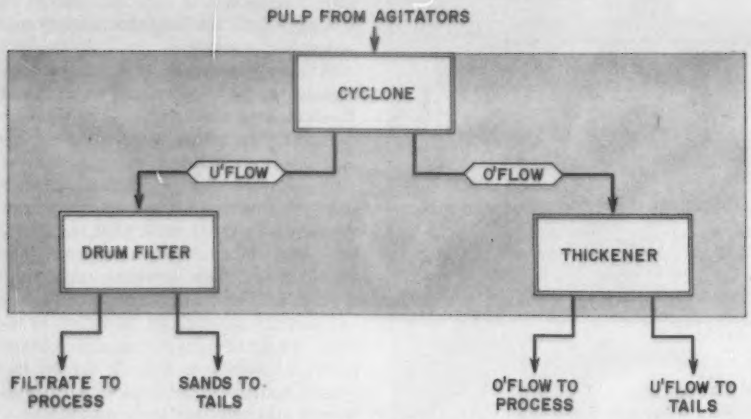


FIG. NO. 6.—cyclones can be used to reduce capital cost, replacing multiple thickener and/or filter installations in the washing filter circuit of gold mills.

synthetic fabrics gaining in favor as deck covering. The use of hard rubber grids for decking is an advance over wood grids. The obvious advantages of an agitated pulp hardly need comment so that practically all modern filters have provision for pulp agitators.

To Cut Capital Costs

As a variation of the conventional counter-current washing cycle, future gold plants will give consideration to making a split of agitator pulps by means of cyclones, with the coarse fraction (cyclone underflow) receiving a displacement wash on a filter and fine fraction handled by a thickener. This circuit is illustrated by Fig. 6. By eliminating the necessity for multiple filter and/or thickener installations, savings will be effected in original equipment costs as well as in operations.

Instrumentation: Without a doubt, the most spectacular advances in future gold plants will center about instrumentation. Push-button milling is at hand and nowhere will automation be more welcome than in processing of gold ore where, traditionally, labor costs have made up from 30 to 60% of direct milling cost, depending on size and type of plant. As the largest single account on the mill cost sheet, the item of labor is the one that must be the target of concerted effort and it is here that a scrutiny of uranium practice will show the shape of things to come in gold mills.

As a starting point, it will be interesting to see just what process controls are available today. A partial list would look somewhat as shown in Fig. No. 14 on p 100. It should not be supposed that all of these would be installed in any one plant; economic balances must be maintained and plant limitations taken into account. The list shows the more common types of instrumentation in the display case, ready to be wrapped up and delivered to the gold metallurgist. And, it must be emphasized, all of these are developed production items, relatively bug-free.

Costs: At this juncture we are ready to take a look at what has happened to prices of various components that are grouped under mill operating costs. To do this, we can compare the Bureau of Labor Statistics indexes for pre-war with current levels. Taking the averages for the year 1940 and for September 1958, as basis for comparison (with 1947 to 49 as 100), the results tabulate as shown in Fig. 7.

Note that, as could be expected, it is increases in labor costs that stand out. The effect is doubly damaging not merely because, percentagewise, labor has increased faster, but also because the item of direct and indirect labor cost does, in many cases, constitute 60 to 70% of total milling costs.

For discussion purposes, let us take the example of a gold plant that was using (1940): 20 kwh per ton, 1½ lb steel per ton and 1 lb cyanide per ton as a basis for comparing how rising prices have affected the costs of these three items. This comparison is tabulated in Fig. 8.

It must be obvious to us all that cost increase in order of 13c per ton, while not insignificant, nevertheless is not of sufficient magnitude as to be fatal. By themselves, these three components of milling cost can hardly be blamed for shutting down any mine.

Thus it sifts down to labor. If present costs are to be kept in line with pre-war milling costs, labor productivity must be increased. This can be done by a combination of three factors:

1. Use of improved techniques and machinery
2. Automation
3. Sound engineering and design

To illustrate, we can take a hypothetical 500-tpd plant employing sand-slime separation. Let me hasten to say that the arrangement of Fig. 1 is used merely to illustrate points we have had under discussion. Obviously, each ore and plant must have its own particular variations to suit the metallurgy, tonnage and physical environment of the plant. The sizing of ball mill, thickeners, pachucas, filters, etc., will, naturally differ just as ores differ.

On Fig. 1, you will note the tabulation of a suggested mill crew which totals 20 men, broken down as indicated into 12 shift operators, 2 crushermen, 2 repairmen, 2 in the laboratory and a mill superintendent and a metallurgist.

If an all-slime circuit is employed, sand leach tanks are eliminated but probably an additional pachuca and an additional drum filter would be required. Labor force might be cut by one man but power costs would rise,

Fig. No. 7—BLS Indexes of Prices on Milling Most Components

Item	1940 Average	1958 Sept.	Percent Increase
Iron & steel—wholesale price index	63.8	171.8	170%
Average hourly earnings—manufacturing	$ 0.61	$2.14	251%
Consumer price index, gas & electricity	103.9	118.0	13%
Aerobrand calcium cyanide	$0.065	$0.080	23%
Cost of living index	59.9	123.9	107%

Fig. No. 8—Tabulation-Comparison 1940 to 1958 Costs for Power, Steel & Cyanide

Item	1940 Unit cost	1940 Cost/ton	1958 Unit cost	1958 Cost/ton	Increase per ton
Power-kwh	$0.012	$0.240	$0.0136	$0.272	$0.032
Steel-lb	0.075	0.113	0.128	0.192	0.079
Cyanide-lb	0.065	0.065	0.080	0.080	0.015
				Total increase/ton	$0.126

reflecting the finer grind. Within space limitations here, we cannot hope to analyze the many possible variations to the basic sand-slime treatment scheme.

Averaging out at $20 per man shift, the daily labor bill is $400 or $0.80 per ton on basis of 500 tpd. Payroll taxes will total 10%, boosting labor costs to $0.88 per ton. Additionally, certain other supplies are required such as lime, zinc dust, possibly some lead nitrate, etc. Allowance must be made for oils and lubricants, for repair parts and, seasonally, for heating. Put together, we arrive at a milling cost that looks like this. (Fig. 9)

Labor Is Cost Target

The only real variable in Fig. 9 is labor, since such items as steel consumption, power, etc. while not entirely fixed, can be whittled down only within a comparatively narrow range. Compared to labor, those costs are relatively inflexible.

Continuing this line of reasoning and assuming that costs other than labor are fixed, we can come up with a set of direct costs for mill tonnages varying from 100 to 1,000 tpd. These costs fall on the hyperbolic curve shown in Fig. 10.

It must be emphasized here that Fig. 10 is a composite, and that the exact form of the curve will vary for each deposit and for each ore. In the main however, the capacity-cost curve for any particular deposit will follow the pattern of Fig. 10.

So much for direct costs. As we are all aware, there are certain capital charges which are a real part of milling cost, these charges provide for amortization of plant and, in addition, must include interest which the money would earn if it had not been applied to building the milling plant. There are various ways to compute amortization and depreciation, all stemming in one form or another, from the Federal income tax regulations.

For our purposes, we shall stick to a fairly simple, straightforward method. We shall assume a 10-year ore reserve and we shall further assume that the milling plant has no value when that 10-year reserve is worked out. Additionally we shall assume that the money could be working to earn 6%. I think we can be in agreement that these are reasonable bases on which to establish the capital charges.

It is impossible to say just what any particular size plant will cost without going into a fairly exhaustive estimate. However, certain basic planning factors can be used to make some generalities which we shall employ in order to carry this analysis further. Before we move to Fig. 11, we must emphasize that these assumed plant cost figures are talking

Fig. No. 9 — Computed 1959 Direct Milling Cost for 500-tpd Plant

Item	Cost/ton
Labor, incl. payroll taxes	$0.880
Power, incl. lighting	0.272
Steel	0.192
Cyanide	0.080
Chemicals (lime, zinc dust, etc.)	0.050
Lubes, repair parts, etc.	0.100
Total direct	$1.574

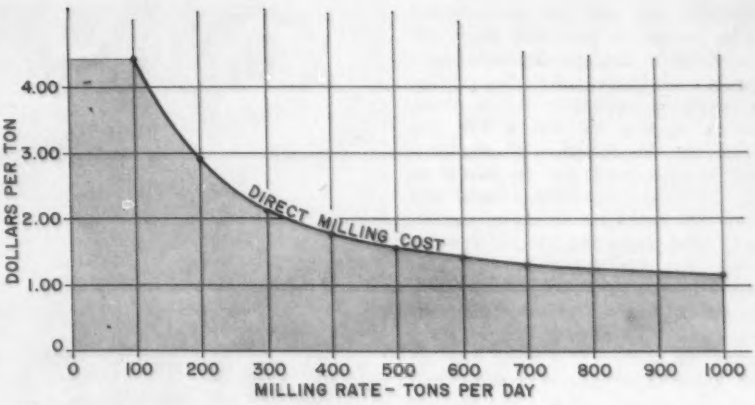


FIG. NO. 10.—the direct milling cost comes down on a hyperbolic curve as the daily milling rate goes up. Costs at 1,000 tpd are only ¼ of those at 100.

Fig. No. 11—Interest and Amortization Schedule

Daily capacity (tons)	Assumed plant cost	Amortization per ton	6% annual interest	Interest per ton	I & A total/ton
100	$ 250,000	$0.71	$15,000	0.43	$1.14
200	450,000	0.64	27,000	0.39	1.03
300	600,000	0.57	36,000	0.34	0.91
400	750,000	0.54	45,000	0.32	0.86
500	900,000	0.52	54,000	0.31	0.83
600	1,050,000	0.50	63,000	0.30	0.80
700	1,200,000	0.49	72,000	0.29	0.78
800	1,300,000	0.46	78,000	0.28	0.74
900	1,400,000	0.44	84,000	0.27	0.71
1000	1,500,000	0.43	90,000	0.26	0.69

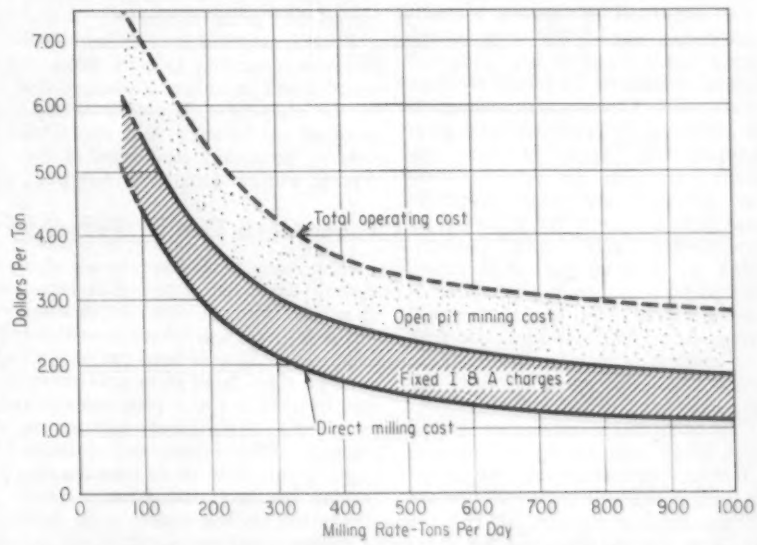


FIG. NO. 12.—the fixed charges are added to the direct charges from Fig. No. 10 as the shaded area between the lower (direct) and the upper (total) cost curves.

numbers only and are not intended to be precise. A particular plant will cost more or cost less, depending on a number of factors. But the average is going to approach the costs as shown on Fig. 11. On a 350 day work-year, the interest and amortization charges work out as shown on Fig. 11. Like direct milling costs, they show the beneficial effects of moderately sized plants 500 tpd and upward.

We are now ready to add these fixed charges to direct milling costs shown on Fig. 10. This situation is graphically illustrated on Fig. 12 where the shaded area lying between the lower curve (direct milling cost) and the upper curve (total milling cost) represents the fixed charge increment.

Based on $5 Rock

Next, by drawing a horizontal line at some fixed dollar value, taken to represent the "average recovered value per ton," we outline an area (above the uppermost curve and below the horizontal line) that represents the daylight remaining from which mining cost, taxes, insurance and general administrative costs must be deducted.

Note here that, at the $5 assumed recovery, the total milling cost of a 130-ton plant eats up the total ore value, leaving no room for mining cost, taxes, etc., and profit. Obviously we must tool up for some tonnage greater than 130 tpd if we are working on $5 ore.

Of course, this situation changes if we raise or lower the horizontal line, that is, if we increase or decrease the recovered value of the ore. These relationships are well known to us all and need not be dwelt upon here.

A discussion of mining methods and costs is outside the scope of this paper, but as much as in milling, the emphasis must be on highly mechanized systems. Underground mining will be restricted to large tonnages or to comparatively small tonnage high grade operations. In between these two extremes are many properties that hold the hope for a revival of the domestic gold mining industry. They will show up as open pit mines, backed up by a highly efficient, labor saving milling plant. In size, they will range from 300 tpd upwards, with the greatest economies beginning to show when the operating level approaches the 500 tpd mark.

To carry this discussion to its final step, let us take the case of an open pit mine from which ore can be delivered to the mill for $1.50 per ton for any tonnage through 200 tpd; for $1.25 at 300 tpd level and for $1.00 per ton beginning at 400 tpd and upwards. Needless to say, these costs imply a reasonable strip ratio but they are not out of line with surface mining as now practiced.

FIG. NO. 13.—pachucas, such as these at Phillips Petroleum's Ambrosia Lake uranium operation, have been a standard tool in gold as well as uranium milling.

By adding the mining cost to total milling cost, the uppermost curve, we can plot the third curve, total operating cost per ton milled, shown on Fig. 12.

It is the intersection of this last curve with a selected ordinate line, a given dollar value, that gives an insight as to minimum requirements for commercial gold operations today. It is quickly apparent from Fig. 12 that a 700,000 ton deposit of $6 ore is a "breakeven" operation at 200 tpd; by raising operating levels to 300 tpd we can drop recovered value to $5. Taken another way, $4 ore must be programmed at better than 400 tpd if investment is to be returned, interest earned and profit realized.

Each deposit will have its individual optimum operating level, a level at which it will provide maximum return on the investment. It cannot be emphasized too strongly that this level must be accurately established or the venture will be doomed to failure.

Labor Costs Can Be Reduced

How many times have we all seen the mistake made of trying to force-fit a mine into an operating bracket where it does not belong, or trying to squeeze a $7 mill head out of a $5 mine or a $10 head from a $7 mine? Wishful thinking is a poor substitute for a cold, dispassionate engineering analysis. What makes the situation tragic is that it is all so unnecessary. Despite the fact that labor is, and always will be, the largest single item in milling cost, unit labor costs can be reduced, or at worst, kept under control, by using old tools with new handles, handles now polished smooth by our cousins in the uranium business.

In conclusion, it is not going too far to say that the state of suspended animation that characterizes our domestic gold mining industry is capable of being given a shot in the arm. Who knows the answers if we do not constructively re-evaluate gold deposits in the light of what can be done with the new look?

Let us worry less about grade and show more concern for mechanization and improved metallurgy. Let us think of costs, not as static but as challenges to our ingenuity and our resourcefulness.

It is our humble opinion that neglect has gone too far, that even today, dollars are to be made in gold simply because the inexorable march of technology has largely compensated for the tissue paper dollar we must work with.

Fig. No. 14—Instrumentation Applicable to Gold Circuits

Bin indicators, alarms
Electrical interlocks on feeder-crusher-screen-conveyor units
Thermal and pressure alarms for bearings and lube systems
Audio sensing systems to control mill feed and ball rate
Cyclone vortex vacuum finder
Automatic density control
Continuous flow meters, controls for solids, liquids or gases
Automatic temperature or pressure controls
Automatic overload controls, discharge regulators
High-low level indicator controls
Filter air and vacuum controls
Intercoms, centralized controls

A Guide to Solid-Liquid Separations—Part II

MR. FONTEIN continues his discussion of solid-liquid separations which started in E&MJ July 1959 p. 82-85. Mr. Fontein has been discussing the methods by which a separation can be made. He has completed his remarks on separations based on a difference in velocity and proceeds to the next two methods—those based on entrainment and those based on holes being larger than the particle size (such as the sieve-bend screen).

F. J. FONTEIN

In many cases this suspension has such a high specific gravity that particles of low specific gravity contained in the feed will float on it and are discharged in the overflow, and consequently in the fine fraction. It is clear that in this case a specific gravity separation is effected on particles much coarser than the particles forming the "teeter bed".

The same can apply to some centrifuges operating with hydraulic water.

A specific gravity separation is also effected in heavy medium washers. In these washers, the medium, often a suspension of fine particles of high specific gravity, has such a specific gravity that one portion of the particles contained in the feed settles in it, while the other particles float. The two portions are discharged separately.

In a normal cyclone with a small cone angle—about 20 deg — particles that do not deviate too much from a spherical shape and whose specific gravity differs a good deal from that of the medium, are separated substantially according to uniform velocity. This will be discussed in greater detail below.

Fig. No. 1 shows the particle sizes, at which in normal cases a cut can be made by the various devices whose operation is based on the differences in velocity of particles in uniform motion in a medium. It is assumed that the specific gravity of the particles to be classified is 2.7 and the medium used is water.

Accelerated or Retarded Motion

The number of apparatus in which this principle is utilized is very great. The acceleration principle is nearly always accompanied by other influences. In most cases, for instance, the resistance the particles experience from the medium influences the velocity of motion so that the particle size still has influence on the separation. In addition, suspensions of high specific gravity very often occur, which means that the separation will also show, to some extent, the characteristics of a sink float separation.

In these devices, use is made of the phenomenon that particles propelled by a flow of liquid over the bottom of a launder make larger "jumps" when their specific gravity is lower. They "jump" because, as a result of contact with each other and with the bottom of the launder, they are forced upwards into the flowing liquid. When they are specifically light, the acceleration in downward direction is only small and it takes a rather long time before they reach the bottom of the launder again. When their specific gravity is high, the acceleration in downward direction is much greater, so that they will reach the bottom of the launder in a short time. As a result of this mechanism, a separation according to specific gravity may be effected.

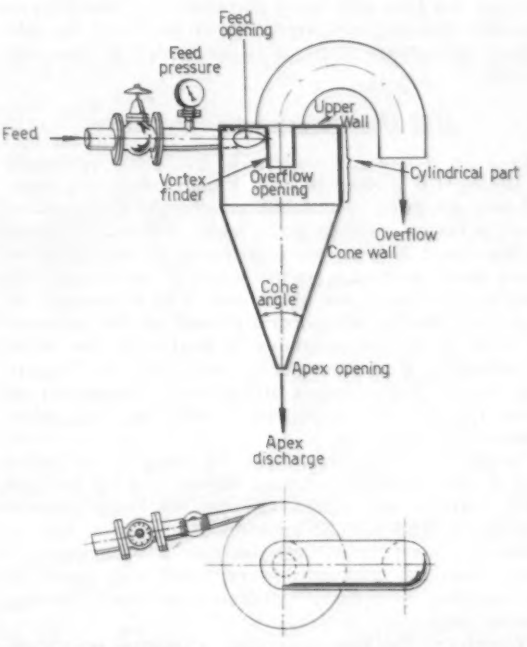
Dr. Fontein is with the mining research establishment, Dutch State Mines.

Because the separating mechanism is very complicated, I will not go into any detail. It is, however, obvious that the accelerated motion plays an important part in this kind of apparatus.

Devices of this type are found in a variety of shapes. In the first place, there are the so-called tables which formerly were universally used in the cleaning of starch. the Rheolaveur used in coal preparation plants, the sluices employed for ore cleaning, the spiral chutes used in concentrating ores. Moreover, there is the purifier in which the principle is applied in a centrifuge. The apparatus is used for purifying starch. The so-called shaking tables are used in various forms.

The apparatus used for the treatment of starch are discussed by Nauta[5], while the devices used in concentrating ores are dealt with by Taggart[6]. The machines for the treatment of coal are described by Dupierry[7].

As regards the separation with flow separators, it can be remarked that big, light particles make the largest "jumps"; they will, on the average, travel at a higher level than small light particles. Moreover, they will move faster.



IN A CYCLONE with a small cone angle, nearly spherical particles with different specific gravities may be separated.

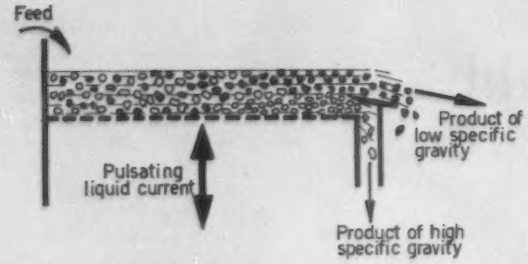


FIG. NO. 6 explains the principles of operation of a jig—which employs the acceleration principle to separate feed.

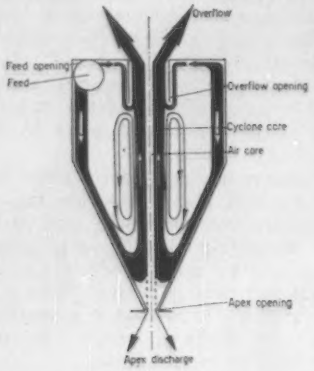


FIG. NO. 7. The non-tangential currents within a wet cyclone are about as shown here, as determined in a glass model.

Small, heavy particles will usually be at the lowest level.

Therefore, the best separation according to specific gravity will be obtained if fractions are treated in which the heavy particles are small and the light particles big. These fractions may be obtained by a separation according to uniform motion in a medium. The nearer the specific gravity of the medium approaches the specific gravity of the light fraction, the larger the difference in size between the light and heavy particles: in consequence, a hydraulic classifier forming a "teeter bed" will be most suitable to prepare fractions to be treated in flow separators.

Jigs Use Acceleration Principle

In a jig, a layer of particles is given the opportunity of sinking for a short time in a liquid. Pulsating water columns are often used, while in other cases a layer of particles lies on a screen under water. The material lying on the screen is given the opportunity of settling in the liquid for a short time, as the screen is suddenly moved downwards through the liquid over a short distance.

A great number of devices are based on this principle. In most cases, the apparatus is used with the object of obtaining a specific gravity separation. In Taggart[6] and Dupierry[7] descriptions of this kind of apparatus are given. Fig. No. 6 is a diagram showing the principle of operation of a jig.

In a flow separator, the light, big particles are highest and the fine, heavy particles are lowest. In a jig, the light, small particles are highest and the big heavy particles are lowest. This can be understood when it is kept in mind that, when the particles are moving with respect to each other, the medium flows upwards with regard to the particles, more easily withdrawing fine particles than coarser ones.

Therefore, the best separation according to specific gravity will be obtained if fractions are treated in which the heavy particles are big and the light particles small. There are no devices available which achieve such a separation. Therefore, the best feed for jigs which can be prepared are fractions containing light and heavy particles of about the same size. These fractions can be obtained with normal screens or with DSM screens.

From the theoretical considerations, it follows that, in principle, a separation according to specific gravity can be effected by the acceleration effect if the particles are alike in shape. If there are flat and spherical particles, the flat ones behave as though they had a low specific gravity. Consequently, a specific gravity separation of a mixture of particles widely differing in shape will seldom be successful, if jigs are used, for the flat particles behave as if they had a low specific gravity, which implies that they will, in general, be incorporated in the light fraction.

In the case of jigs, flat particles will behave as though they had a low specific gravity, because they will orientate themselves perpendicular to the direction of movement and remain in this position as long as the separation takes place.

In the case of flow separators, the direction of orientation will change every moment. Flow separators, then, will be superior to jigs in separating particles of different shape according to specific gravity.

Cyclone Separations

Experiments with cyclones have shown that in these devices certain particles are always separated according to the acceleration principal. The design of the cyclone determines the specific gravity at which the cut will be made.

In normal cyclones having a small cone angle (an angle of about 20 deg), only particles having a specific gravity slightly higher than the specific gravity of the medium are separated according to acceleration. As has already been said, the particles of high specific gravity are separated mainly according to velocity in uniform motion.

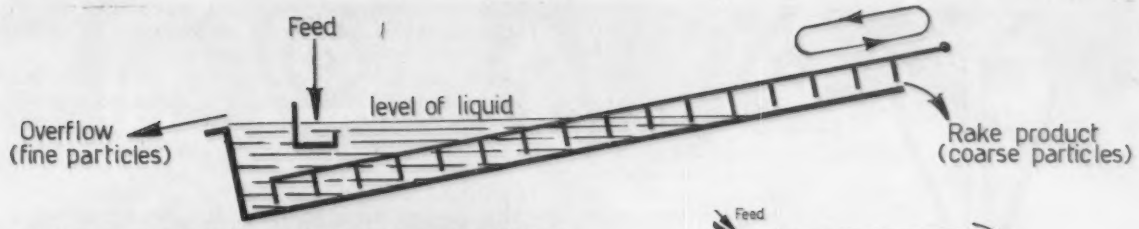
This separating mechanism occurring in cyclones was first pointed out by Fontein and Dijksman[8]. For the sake of completeness and because erroneous views about the operation of the cyclone are still widely held, we shall discuss this aspect of the operation.

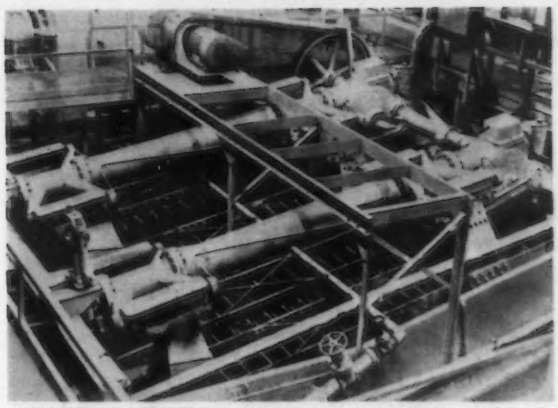
The non-tangential currents in a cyclone are shown in Fig. No. 7. The flow pattern has been brought out by injecting ink at different places in a perspex cyclone, operated with water. The presence of the eddy was quite obvious. When, for instance, a lot of ink is injected together with the feed and suddenly this feed of ink is stopped, the region of the eddy remains blue for quite a time. Van Tongeren[9] was the first to point out the presence of this eddy.

The eddy, however, is much flatter than he indicates. That the eddy must be flat, so be restricted to a cylinder having a diameter only somewhat larger than the diameter of the vortex finder, will be clear when it is kept in mind that medium present in a cyclone at a small radius has lost a considerable lot of its original energy, and is therefore not capable of penetrating to a much larger radius, where the medium has much more energy. When the feed and overflow openings are small, in comparison with the cyclone diameter, it often occurs that flat eddies concentric with each other are present (see Fig. No. 8).

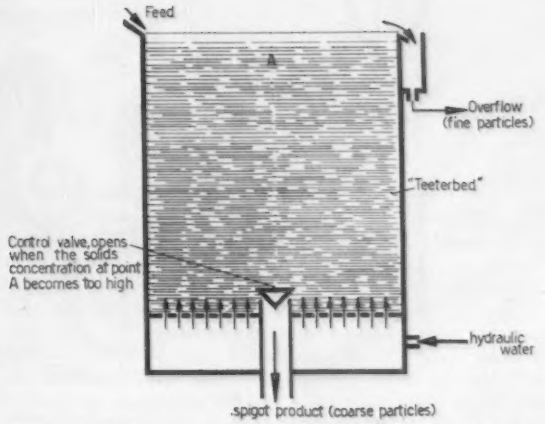
That the non-tangential currents in a cyclone chiefly follow the walls of the cyclone will be clear when the following points are kept in mind.

In a cyclone, the medium is tangentially supplied at the circumference and discharged at a short distance from

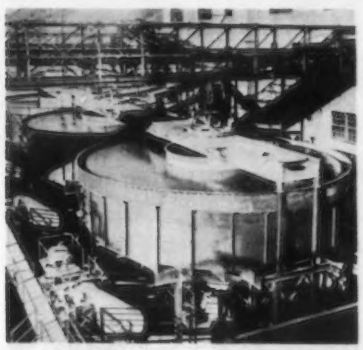


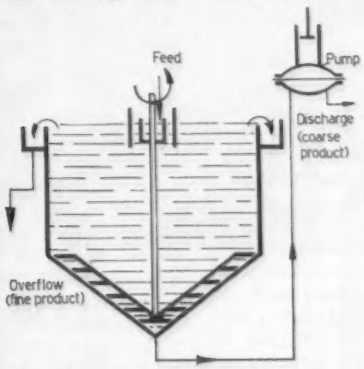


A RAKE CLASSIFIER continually re-suspends the particles in the medium as it rakes the larger sand up the discharge ramp.

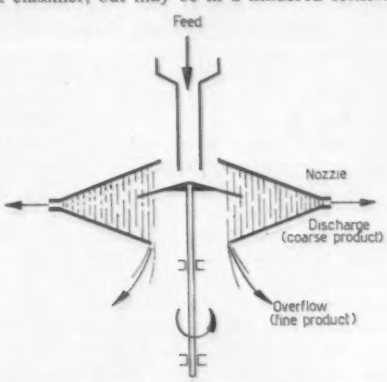


A SEPARATION according to specific gravity is seldom obtained in a normal classifier, but may be in a hindered settler.

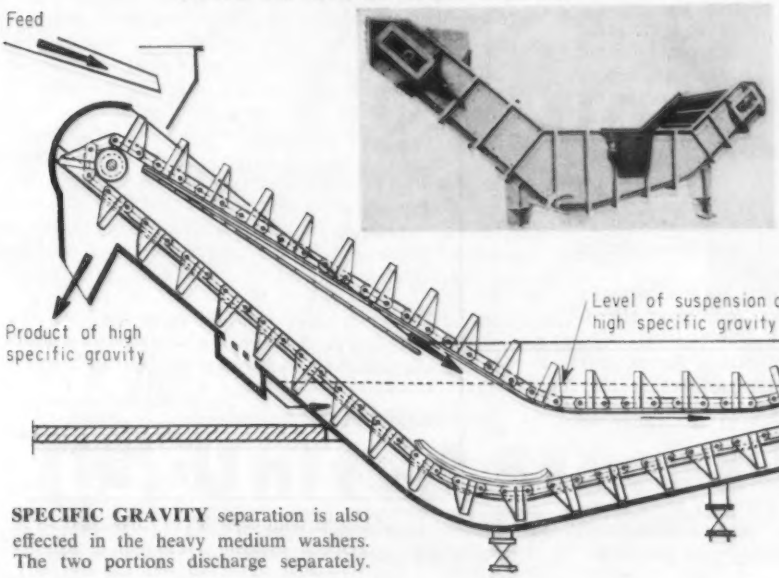




CLASSIFIERS and hydroseparators are essentially tanks into which a mixture of particles and liquid are fed and withdrawn.



IN CENTRIFUGES, the rapidly settling fraction travels against the current.



SPECIFIC GRAVITY separation is also effected in the heavy medium washers. The two portions discharge separately.

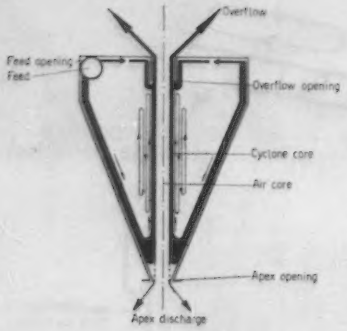


FIG. NO. 8. When feed and overflow opening are small, in comparison with cyclone diameter, flat eddy currents occur.

the axis. Consequently, there must be in addition to the tangential currents non-tangential currents with components in radial direction to the centre of the cyclone. These "non-tangential currents" are, as already mentioned, shown in Fig. No. 7.

The centrifugal force acts against these currents. For this reason a rough-walled cyclone has, at the same feed pressure, a larger capacity than a cyclone with a smooth wall. In the latter cyclone the tangential velocities and hence the centrifugal force will be greater as a result of lower check on the tangential flow. As a result of this the currents from the circumference to the centre will experience a stronger resistance. This means at the same feed velocity a larger feed pressure or at the same feed pressure a smaller capacity.

It will now be clear that the non-tangential currents in a cyclone will be strongest at those places where there is the strongest check on the tangential flow, along the walls and in particular along the large conical wall. The latter current extends to deep in the cone of the cyclone.

If, into a cyclone, particles are fed together with the liquid, which have a specific gravity higher than that of the liquid, then these particles will, if the apex discharge capacity is low, gather themselves in the region just above the apex discharge opening. Here the concentration of solid particles will in consequence become very high. As the non-tangential current along the conical wall passes this region, many of these particles will be entrained by the current which flows rapidly along the air core towards the overflow opening. Only particles which leave the flow around the air core before the flow reaches the vortex finder will be recycled to the apex of the cyclone. It will be clear that only these particles have a great chance of leaving the cyclone through the apex opening.

Whether a particle can leave the cyclone core before reaching the vortex finder depends on the distance the particle, which at first has no radial velocity, covers in radial sense in a very short time. The formula:

$$S = \frac{1}{2}\,\frac{\rho_p - \rho_l}{\rho_p + A\rho_l}\,t^2\,g^* \qquad \text{Eq. 4}$$

applies here if the resistance caused by the motion of the particle with respect to the liquid may be neglected in comparison with the forces of inertia.

From the foregoing it is clear that in a cyclone a separation based upon the acceleration principle is affected.

It is furthermore clear that the resistance forces may only be neglected in the case of coarse particles.

As the quotient $\frac{force\ of\ resistance}{forces\ of\ inertia}$ in the range of laminar flow is proportional to $1/d^2$ and in the range of turbulent flow to $1/d$, the influence of the resistance increases with small particle diameter. For very small particle diameters this force of resistance will—almost from the start of the motion in radial direction—be practically equal to the centrifugal force and therefore the rate of fall will, almost immediately, be practically equal to the rate calculated by Stokes' law (see Fig. No. 2).

Consequently, for very small particles not formula (4) but the following formula according to Stokes holds good:

$$S = ut = \tfrac{1}{18} g^* d^2 \frac{\rho_p - \rho_l}{\mu} t \qquad \text{Eq. 12}$$

In principal it may be expected that a determination of the 50% particle size, (the size of the particles, of which 50% are removed from the water escaping through the overflow), for a given cyclone treating particles of different specific gravity will lead to a curve, which, drawn on a logarithmical scale, will look as shown in Fig. No. 9.

Fig. No. 10 shows data which have been accumulated during tests with a 350 mm cyclone. The experimental results are roughly in accordance with the theoretical expectation.

If we assume that the diameter of the air core and the g^* value are independent of the length of the cyclone, all other variables remaining constant, then t in Eq. 4 and 12 will be inversely proportional to the cyclone length. This means that a cyclone 2 times longer will give a $\rho_p - \rho_l$ value for coarse particles, one-fourth of the original value and $\rho_p - \rho_l$ value for fine specifically heavy particles, ½ of the original value.

In practice, the suppositions concerning the air core and g^* are not borne out. Yet it is true that with longer cyclones the $\rho_p - \rho_l$ value for coarse particles, of which 50% are removed from the water escaping through the overflow, decreases rapidly with the length, while this decrease is much less rapid for smaller particles of high specific gravity.

From the foregoing it will be clear that in a cyclone, coarse particles of low specific gravity will more or less be separated according to specific gravity. The overflow will be free from specifically heavy coarse particles; the apex discharge, however, can contain a small percentage of coarse light particles, which have not been swept upwards in the core and in consequence have not had the chance of leaving the overflow. A long cyclone will give a lower specific gravity of separation than a short cyclone. This is clear from practice too. For extracting dirt from paper fibers, which have a specific gravity only slightly higher than water, very long cyclones are used (see Fontein[11]), while a so-called cyclone washer with water

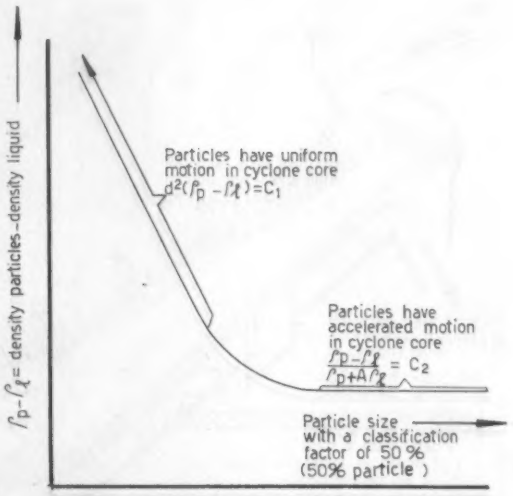
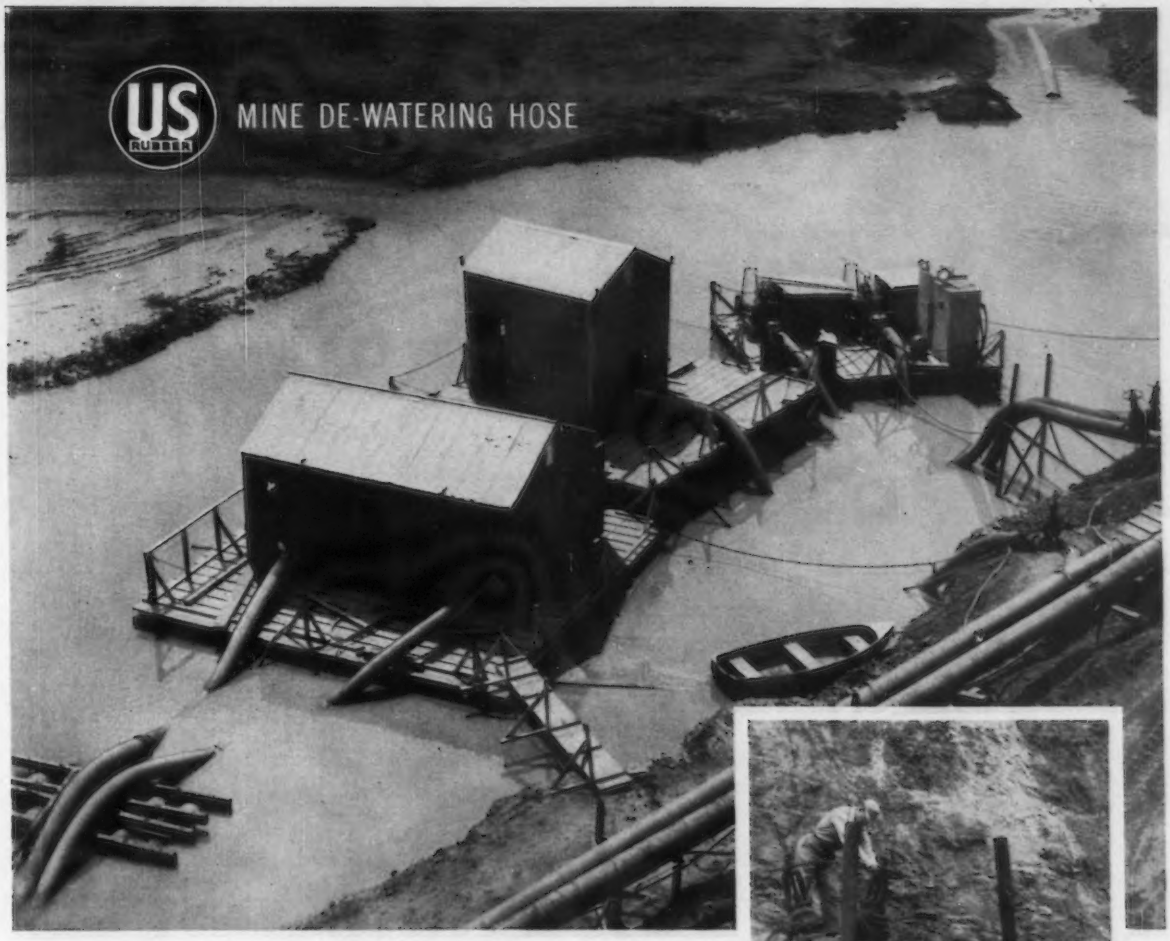

$\rho_p - \rho_l$ = density particles-density liquid
Particles have uniform motion in cyclone core
$d^2(\rho_p - \rho_l) = C_1$
Particles have accelerated motion in cyclone core
$\frac{\rho_p - \rho_l}{\rho_p + A\rho_l} = C_2$
Particle size with a classification factor of 50 % (50% particle)

FIG. NO. 9. For a given cyclone, treating particles of different specific gravity, the logarithmic curve will look thus.



Withstands high pressures to keep the crushing plant working

The crushing plant, located in the pit area of one of the world's largest metal mines, must be kept *dry* despite frequent, heavy rains. To do this requires an average pumping output of 7,500 gallons per minute, using "U.S." wirecord-built Mine De-Watering Hose.

This hose is mounted on floating rafts, where its extreme flexibility allows it to rise and fall with the water. Yet despite its flexibility, it withstands pressures up to 350 lbs.—as compared with the 250-lb. top pressures of conventional fabric-built hose.

U.S. Mine De-Watering Hose is the one sure way of controlling subterranean streams within the mine, as well as controlling heavy rains and snows that could cause floods and work stoppage. The dependable stamina of this hose is one reason why U.S. Rubber is the largest manufacturer of the widest range of industrial rubber products serving industry.

• • •

When you think of rubber, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Note flexibility of
U. S. Mine De-Watering Hose

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

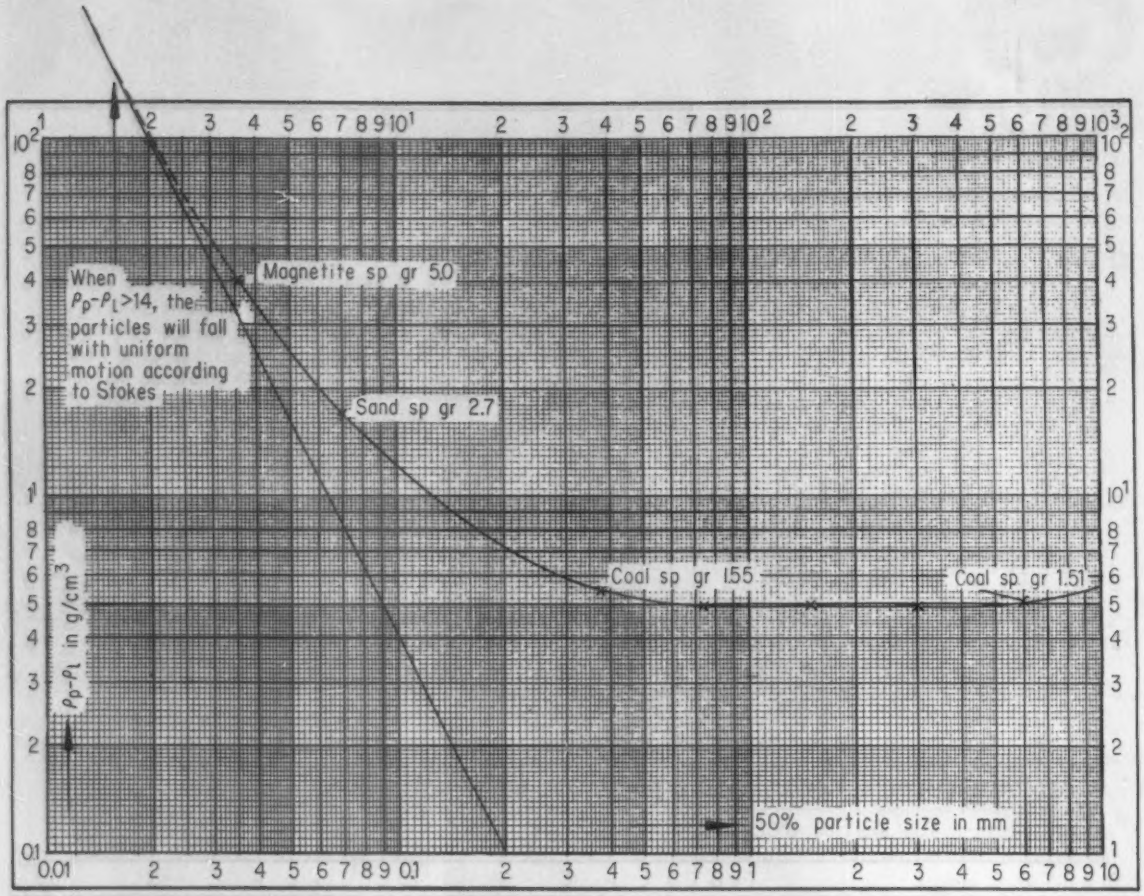

When $\rho_p-\rho_l>14$, the particles will fall with uniform motion according to Stokes
Magnetite sp gr 5.0
Sand sp gr 2.7
Coal sp gr 1.55
Coal sp gr 1.51
$\rho_p-\rho_l$ in g/cm^3
50% particle size in mm

FIG. NO. 10. Data accumulated during tests with a 350 mm diameter cyclone, when plotted as above, show that the experimental results are roughly in accordance with the theoretical expectations as discussed in the text by the author.

for coal is relatively short. See Fontein and Dijksman[8].

In a cyclone operated as "cyclone washer with water" the coarse particles, when not of the same order of magnitude as the thickness of the cyclone core, are separated at a somewhat lower specific gravity than the particles which are smaller. This is due to the fact that the resistance still has some influence on the motion of coarse particles (see Fig. No. 10).

In this respect a cyclone has the same characteristics as a jig, for which reason also the results of a cyclone washer with water can be improved by giving it a feed consisting of size fractions obtained by screening. Particles which under the influence of gravity fall according to Stokes, very often fall in a cyclone, according to Newton-Rittinger, or have Reynolds' numbers in the Allen range.

This is one of the reasons why a cyclone will catch spherical particles and throw flat particles having the same velocity as the spherical ones in the overflow. The acceleration effect strengthens this tendency because, as a result of this mechanism, flat particles behave as if they had a lower specific gravity than they in reality have.

Based on Holes Being Larger than the Particles

This principle always leads to a separation according to particle size, the so-called screening. Whether the particle goes into the fine product or into the coarse fraction, only depends on the size and the shape of the particles and on the size and the shape of the openings. The specific gravity of the particle is of no importance in this case.

As the principle of screening is simple and no special effects are produced, this point will not be further discussed.

Screening

The devices based on this principle, the screens, exist in a wide variety of designs. Those most widely used are the so-called vibration screens, while in some cases use is still made of revolving drums fitted with screens. In some devices of the screen type, use is made of the centrifugal force. This kind of centrifugal screen, which is manufactured to various designs, is still in the development stage and has not yet found wide application. In general, it may be said that screens are still constantly being improved upon. Technical advance in this field is still in full progress.

Especially if the cut is to be made at a small diameter, the capacity of a screen is very low. In the potato starch industry, where vibrating screens are used, covered with silk or nylon screen cloth with openings of about 100 micron, a vibrating screen with an area of about 20 sq ft has a capacity of only 14 to 16 gal/min of potato starch suspension. Finer screening is practically out of the question here, because in this case the openings in the

B.F.Goodrich

B.F. Goodrich tires carry 44-ton gross loads for strip miner, still can be retreaded twice

J. Robert Bazley, Inc. of Pottsville, Pa., strip mines throughout the anthracite region, also builds roads all over the state. The company operates 217 rubber-tired vehicles working as many as 70 hours a week. The truck above carries 22 tons of rock and dirt overburden. Add the vehicle weight, and you have a 44-ton gross load for those tires to carry over razor-sharp rock!

Yet the tires can be retreaded *twice!* This is possible because the tires are B.F.Goodrich Rock Service tires—specially built for this kind of work. Massive double-chevron cleats defy rock cuts and bruises, pull in forward or reverse. B.F.Goodrich FLEX-RITE NYLON cords withstand double the impact of ordinary materials, resist heat blowouts and flex breaks. Result: this B.F.Goodrich Rock Service tire body outwears even the extra-thick tread, can be retreaded again and again!

Follow the lead of successful strip miners like J. Robert Bazley. Switch to B.F.Goodrich Rock Service tires. You'll be dollars ahead. Your B.F.Goodrich Smileage dealer is listed under Tires in the Yellow Pages of your phone book. See him today. *The B.F.Goodrich Co., Akron 18, Ohio.*

Specify B.F.Goodrich tires when ordering new equipment

Smileage!

B.F.Goodrich *off-the-road tires*

screen cloth would become as large as the coarser starch particles.

The screens would then get blocked and the capacity would drop rapidly. In general it may be said that the capacity of a screen drops sharply, if the material to be screened contains a high percentage of particles, whose size is of the same order as the size of the screen apertures, so that these particles can easily block the screen.

In this connection it should be remarked that the wet screening of materials such as ores and coals at sizes smaller than 0.5 mm is a problem that cannot be solved satisfactorily with the screens now available. Screening at small sizes, with normal vibrating screens, is expensive because the screen decks are rapidly worn and, in general, need much repair and maintenance.

Based on Entrainment

In practice, this principle, upon which the operation of the DSM sieve bend screen is based, produces a separation similar to that obtained by normal screening. This principle of operation has been explained in detail by Fontein[2]; it will not be further discussed here, as it will be described later on, when the apparatus DSM sieve bend screen is dealt with.

As to the separation, it is sufficient to remark that in principle a DSM screen may be expected to yield an underflow containing a very low percentage of particles about twice as large as the particle size at which the cut is made. With a normal screen such coarse particles cannot, theoretically, get into the undersize fraction. Yet, in practice this happens in many cases as a result of inaccurate finishing of the screen surface or on account of the presence of chinks between screen deck and frame.

In practice, a DSM sieve bend screen produces a separation comparable with or better than the separation effected by a screen.

DSM Screens

As the DSM screen is a comparatively recent development, a short description of its operation will be given. Fig. No. 11 shows a DSM sieve bend screen for screening at 0.5 mm.

A mixture of particles and liquid is introduced into the weir box and flows via the vertical funnel tangentially on to a curved screen surface. The screen is made of stainless steel wedge wire, with the bars perpendicular to the direction of flow. For screening at 0.5 mm the slots must be about 1 mm wide.

The layer of liquid flowing across the slotted screen becomes thinner after passing a slot, as a layer of about ¼ mm thickness spouts through the slot (see Fig. 12), with a velocity smaller than the feed-velocity.

Particles bigger than 0.5 mm are contained for more than half of their size in the main current flowing across the slot; consequently, they remain in this flow and are discharged in the overflow. Particles smaller than 0.5 mm can be entrained by the 0.25 mm liquid layer passing through the slots. As particles of 0.5 mm cannot block slots of 1 mm, the DSM screen does not block at all.

The most recent article on this subject is Fontein[10]. So far, DSM screens for screening at about 20 microns to about 4 mm have been developed. The great advantage is that, while effecting a separation similar to that obtained by normal screening, they have a much larger capacity and, if well designed, do not block, not even when a lot of near size material is present in the feed. This is the reason why the capacity is not affected by the solids in the feed.

For screening potato starch suspensions at about 100

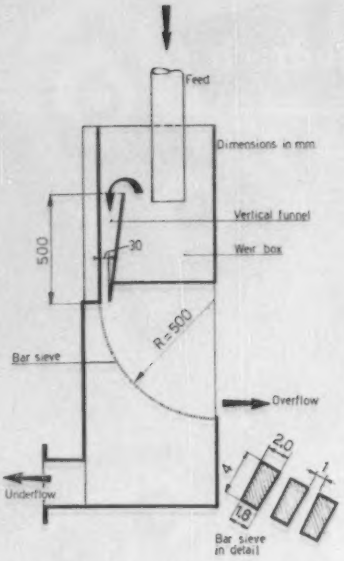


FIG. NO. 11. A Dutch State Mine's sieve bend screen for screening at 0.5 mm is described in the text.

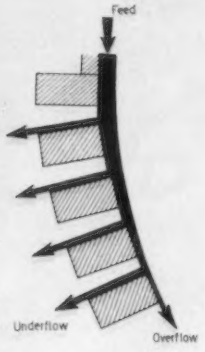


FIG. NO. 12 The layer of liquid flows across the slots as a particle-bearing layer spouts through.

microns, use is being made of DSM screens which, having a screen area of 2 sq ft reach a capacity of 140 to 160 gal. min. This means that the capacity per unit of screen area is about 100 times as great in this case as for vibrating screens.

With a DSM screen it is furthermore possible to make a separation at a particle size of the same order as the size of the starch particles without blockage taking place. It is even possible to make a cut at such a fine size, that a large part of the starch particles goes into the coarse fraction. The starch suspension can thus be separated into several fractions which can then be cleaned separately, for instance in a cyclone. From what has been said in the discussion of the cylones, it will be clear that separate treatment of screening fractions facilitiates the cleaning process in cyclones.

The author thanks the management of the Dutch State Mines for their permission to publish this paper and his colleagues of the Mining Research Establishment for their assistance.

Literature Cited

[1]Neumark, S., "Beschleunigungswiderstand geradlinig bewegter Körper in einer idealen Flussigkeit." *Zeitschrift fur angewandte Mathematik und Mechanik, 16,* 117/120 (1936).

[2]Fontein, F. J., "De zeefbocht, nieuw apparaat voor het nat afzeven op fijne zeefmaten." *De Ingenieur, 68,* Ch 1/Ch 5 (1956) no. 5.

[3]*Encyclopedia of Chemical Technology,* 1954. Volume 12, pp. 527/539.

[4]Mitchell, D. R., *Coal Preparation.* 2nd ed. 1950. New York, pp. 391/434, 470/531.

[5]Nauta, R. C., "Separatoren, hoofdzakelijk voor het continu scheiden of klaren van vloeistoffen." *De Ingenieur, 64,* Ch 23/Ch 31 (1952).

Kerr, R. W., *Chemistry and Industry of Starch.* 2nd ed. 1950. New York.

[6]Taggart, A. F., *Handbook of Mineral Dressing.* Ores and industrial minerals. 1954. New York—London.

[7]Dupierry, E., *Die Aufbereitung der Steinkohle.* Dortmund 1941. Hrsg. von Schuchtermann und Kremer-Baum.

[8]Fontein, F. J. and Dijksman, C., "The hydrocyclone, its application and its explanation." *Recent Developments in Mineral Dressing.* 1953 London pp. 229/257.

[9]Van Tongeren, H., "A modern dust collector—A study of the principles governing its design and operation." *Mechanical Engineering, 57,* 753/759 (1935).

[10]Fontein, F. J., "The DSM sieve bend. Recent developments in apparatus for wet screening at fine sizes." *South African Mining & Engineering Journal, 68,* 989/997 (1957). Part 1.

[11]Fontein, F. J., "Das Bogensieb der niederlandischen Staatsmijnen, ein neues Gerat zur nassen Siebung von Feinkohle." *Gluckauf, 91,* 781/786 1955. Heft 27/28.

Drills up to 30 feet an hour in granite

MISSION HAMMERDRIL

Trade Mark

Hole Impact Tool

The Mission HAMMERBIT

Patents issued and pending

Here's the economical answer to high speed drilling in hard rock. The HAMMERDRIL® is economical because of its design—only two moving parts in the high pressure tool, and only three moving parts in the low pressure tool. Economical because impact parts are heat-treated high alloy steel, moving parts are friction and wear resistant. Economical because you can use it on your present rotary rig with suitable air compressor capacity. Mission HAMMERBITS® feature massive tungsten carbide inserts which can be *resharpened in the field.* The HAMMERDRIL with the HAMMERBIT cuts the cost per foot of drilling every foot through hard rock.

The Mission HAMMERDRIL is sold and serviced throughout the United States. Write to Mission for more information on what the HAMMERDRIL can save you—actual field savings under field conditions.

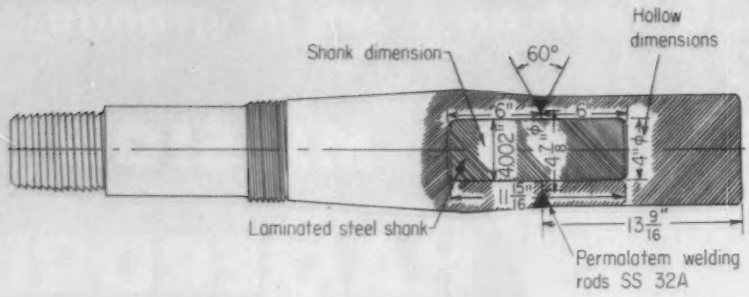
Nothing but the finest will bear the name of MISSION MANUFACTURING CO

Serving the Petroleum Industry for Over Thirty Years

59-500

MISSION MANUFACTURING CO., P. O. Box 4209, Houston, Texas • Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
In The United Kingdom: MISSION MANUFACTURING CO., LTD., 17 Hanover Square, London W. 1 England • Cable Address—"Missoman"
Pistons • Piston Rods • Slips • Gland Packings • Liners • Liner Packing • Pump Valves and Seats • Swabs • Valves • Hammerdrils • Centrifugal Pumps

OPERATING IDEAS



How to Repair Gyratory Crusher Main Shaft

AN EFFECTIVE SYSTEM for repairing the main shaft of a gyratory crusher has been worked out by master mechanic Puz, Patagua Mine, Chile.

Here's the operation as described by mine manager S. Vicencio.

"The lower part of the broken shaft was placed in the lathe and the broken face turned perpendicular to the center of the shaft, taking off a minimum amount of material. A 30-deg cut was made, leaving a 4⅞-in. dia between the two V cuts. Then it was hollowed in the lathe to a diameter of 4 in. and a depth of 6 in. Exactly the same was done with the other half of the shaft.

"A piece of steel shaft was then turned to exactly 4.002-in., 2/1,000 in. greater than the internal diameter cut inside the shaft. This piece of shafting was made exactly 11 15/16-in. long (1/16-in. less than the depth of the two perforations made in the shaft) to make sure that there would be a good contact at the cuts.

"To place the inner piece of shaft in position, the upper part of the shaft was placed upside down and the hollow portion was heated to about 300 deg C by means of an oxyacetylene torch. The shank was then put in place and left to cool slowly. The lower end of the shaft was heated in the same way and placed in position.

"To insure a good contact, the two halves of the shaft were pressured against each other and the cooling near the junction was speeded up by means of wet pieces of cloth.

"During welding, the shaft was kept horizontal and firmly set on a solid support to avoid bending, and, though the welding rods melt at a low temperature, welding was done slowly to prevent heating. Finally, the shaft was placed in the lathe to cut away the excess welding material and to find out whether the shaft was absolutely straight—it was.

"Fourteen lb of welding rods were used in the Patagua process. After repairs, the shaft was 1 in. shorter, but this did not affect its operation in any way."

Cheap Plastic Tube Airs a Mine

SEAMLESS POLYETHYLENE TUBING has reduced the cost of auxiliary ventilation installation in development headings at Minerva Oil Co. fluorspar mines, southern Illinois.

Clear material (10 mil thickness and costing about 8c per lineal ft) is purchased in the form of a continuous 12-in. dia tube which has been installed in continuous lengths of up to 500 ft without any internal tube support. The tubing is threaded through 14-in. diameter hoops (made from 2-in. wide strips of 18 gage galvanized steel sheet) which hang from plugs placed in pin holes at intervals of 20 to 40 ft. Fan pressure inflates the tubing within the hoops and there is no fixed connection to the hoops.

As headings advance, 50- to 75-ft sections of tubing are added to the line by means of sleeve couplings made from 3-in. strips of 18 gage galvanized sheet. The total cost per ft of tubing installed, including both hoops and couplings, comes to less than 20c.

Jeffrey No. 4 blowers, powered by 5-hp motors, are being used to deliver auxiliary air through tube lines for distances of 800 ft, and Minerva reports that, using normal care, no more damage is suffered from blasting than has been experienced with fabric tubing.

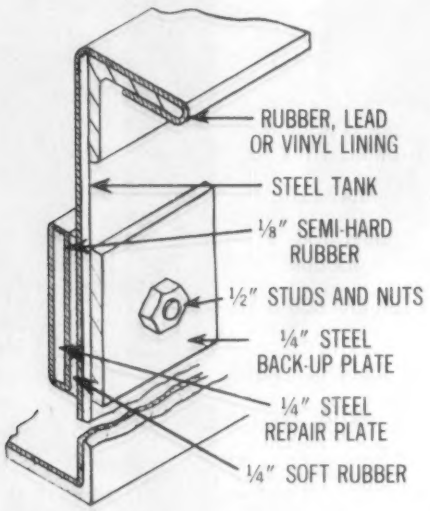


Plate Quickly Seals Tank Leaks

LEAKING LINED ACID TANKS are now quickly repaired in position with the Camac repair plate which requires no solvents or cements, according to Carl Buck & Associates, Essex Fells, N.J.

The plate is covered with ⅛-in. thick semi-hard rubber over which a ¼-in. soft rubber gasket is vulcanized on the plate's tank side. Repair unit comes with studs, nuts and back up plate.

The company said to use the back up plate as a template and drill through the tank from lining side with a 9/16-in. drill. Then insert studs on back of the repair plate through the holes, place back up plate over the studs and tighten nuts to complete the repair.

DENVER ORE TEST SERVICE

Assure Mining Profits By Eliminating Risks

Follow these 5 easy steps:

1. Engage a competent mining engineer or geologist to examine your property.

2. Have him secure a representative sample for a preliminary examination. DENVER Equipment Company will make this examination for you quickly—*without any cost to you.*

3. If preliminary examination is favorable, follow up with a larger mill sample for more extensive laboratory testing to establish operating conditions and flowsheet. DENVER Equipment Company will do this for you *at cost.*

4. Flowsheet and data presented will enable your design engineer to make preliminary layout and estimate. DENVER Equipment Company will do this for you—or will assist your engineers if desired. Description and size of equipment to produce desired tonnage is supplied. You can, from one source of supply, secure complete service and mill equipment.

5. The resulting mill, whether small or large, will be simple and efficient—with operating profits assured.

Assure your mining investment, verify or improve your mill operation with DENVER Ore Tests. Write for sample-shipping tags.

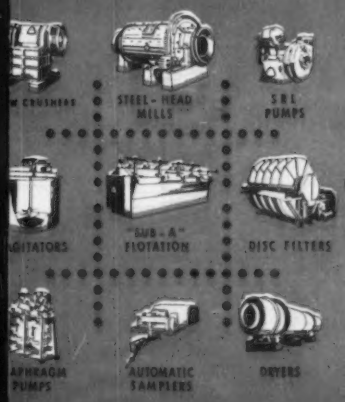
A Complete, Reliable Service

DENVER Ore Test Service is complete and reliable, backed by over 30 years of field, laboratory, design and operating experience. Government bureaus, banks, consulting engineers, financial backers and operating companies depend on DENVER for accurate, reliable test reports. In addition, many large companies and consulting engineers call upon DENVER to verify or check their own results.

DENVER Ore Test Services

include both batch and pilot plant investigations in:

Crushing	Gravity Concentration	Settling
Screening	Heavy Media	Thickening
Grinding and Classification	Agitation	Waste Disposal
	Scrubbing	Water Reclamation
Jigging	Reagent Determination	Pollution Control
Tabling	Pumping	Filtering
Flotation	Sampling	Drying



"The firm that makes its friends happier, healthier and wealthier"

DECO ENGINEERS — STANDARD RELIABLE 24 HOUR SERVICE EFFICIENT

DENVER EQUIPMENT COMPANY

Cable DECO DENVER

1400 Seventeenth St.

Phone CHerry 4-4466

Denver 17, Colorado

NEW YORK CITY
4114 Empire State Bldg.
Phone CH 4-6510

LONDON
15-17 Christopher St.
Finsbury Square
Phone Monarch 3730

JOHANNESBURG
9th Ave. and Broadway
Bez Valley
Phone 25-7531

TORONTO
185 Bay Street
Phone EMpire 3-8836

VANCOUVER
802 Credit Foncier Bldg.
Phone Marine 4918

MEXICO CITY
Avenida Juarez 14, Desp 615
Phone 211477

LIMA
AVDA Orrantia 1570
San Isidro

WHAT'S NEW IN U.S. PATENTS

OLIVER S. NORTH

Exploration

Design for a highly convenient instrument for simultaneously providing all data necessary for determining the dip and strike of geological strata with optimum accuracy. E. L. Howard. No. 2,878,578.

Mining

Improved clay-paraffin blasting plug for stemming loaded blast holes. Lug is positioned in the hole and a wedge tamped into its end to spread the plug into contact with the walls of the hole with sufficient force to resist blast back pressure. L. W. Householder, assigned to National Mine Service Co. No. 2,876,700.

Metal and Mineral Processing

Froth flotation process for recovery of columbium minerals, such as pyrochlore, perovskite, niocalite, and betafite. Ore is finely ground, pulped with water and conditioned with 8-quinolinol, and the conditioned pulp agitated and aerated. Columbium minerals are concentrated in the froth. A. W. Last and K. F. Marquardson, assigned to Kennecott Copper Corp. No. 2,875,896.

Design for the Fanning Concentrator. The stream of ore particles is effectively spread and stratified, and accurately split into component fractions. Apparatus has high capacity at a high pulp density. R. V. Spencer, assigned to J. Hall Carpenter. No. 2,875,898.

Process for producing pure rhenium compounds from impure rhenium-bearing solutions, such as flue dusts and gases derived from the roasting of certain molybdenite concentrates. Ion-exchange is used, followed by chemical treatment and selective precipitation of the rhenium compounds. S. R. Zimmerley and J. D. Prater, assigned to Kennecott Copper Corp. No. 2,876,065.

Chemical process of treating titanium-bearing slags, such as the Sorel slag obtained by reduction of low-grade Canadian ilmenite ores. Slag is heated until rutile crystals form and then cooled and crushed. Rutile crystals are separated from impurities. A. J. Johnson, assigned to Columbia-Southern Chemical Corp. No. 2,876,074.

As a means of preventing sticking of particles during the fluidized bed method of direct reduction of iron oxide ores, a high-purity ore, such as that of Venezuela, is mixed with a Mesabi or other siliceous ore. Composite material can be heated satisfactorily to temperatures exceeding 1200 deg F. T. F. Reed, assigned to U.S. Steel Corp. No. 2,876,091.

Process for smelting iron oxide ore fines in a vertical shaft furnace, whereby cost of milling is reduced and the necessity for sintering or otherwise agglomerating the ore fines before smelting is obviated. W. E. Greenawalt. Nos. 2,876,092-3.

System of mixing and distributing lead, zinc, or iron ore concentrates onto sintering machine pallets in such a manner as to form a deep bed of uniformly permeable material suitable for updraft or downdraft sintering operations. R. C. McDowell and T. E. Ban, assigned to McDowell Co., Inc. No. 2,876,489.

Design for a rotary inclined disc for granulating or pelletizing magnetite concentrate or the like: the disc has a collar inclined at an angle of 10 to 15 deg to the plane of the disc, and the pellets roll over this collar without having to fall from any appreciable height, onto a conveyor band. K. Meyer, assigned to Metallgesellschaft A.G. No. 2,876,491.

COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D. C.

Non-electrical method for removing entrained alkali metal cyanides from ferromanganese furnace gases. Cyanides are converted into gaseous products by recycling them through a gas washer. J. S. Mackay, assigned to Pittsburgh Coke & Chemical Co. No. 2,877,086.

Process for treating sulphur ores or other solid sulphur-bearing materials to produce elemental sulphur. Sulphur content of the ore is vaporized, or sublimed, so rapidly that it does not pass through a viscous stage. H. J. Hartley and C. S. Rankin, assigned to Pacific Foundry Co. Ltd. No. 2,877,100.

In a chemical process for reducing iron oxide ores, the ground ore is mixed with preheated bodies, such as small steel or ceramic balls, which act as heat donors. Thus, the hydrogen must supply only its combustion heat, and therefore it can be used in lesser quantity and at lower temperature than when a part of the reaction heat must be derived therefrom. O. E. A. Aspegren, assigned to Oil Shale Corp. No. 2,877,106.

As a means of retention of fine particles, such as iron or nickel ore fines, in fluidized systems, the material is sized into relatively coarse and fine fractions and the coarse particles preheated to 700-900 deg F and then re-combined with the fines and introduced into the reduction vessel. J. F. Magness, assigned to Pan American Petroleum Corp. No. 2,877,107.

Process for high-temperature reduction of taconite or other low-grade iron ores, whereby the sensible heat of the reaction is efficiently utilized. Ore lumps are reduced with finely divided char, and the product mixed with a high-volatile coal and heated. Solid char and the combustible volatile fraction thereafter are utilized in the reduction of additional quantities of ore. R. P. Smith and D. E. Babcock, assigned to R-N Corp. No. 2,877,108.

Process for recovering pure, carbon-free manganese from metallurgical dusts or slags, oxide ores, and the like. The material is contacted with a chloridizing gas at optimum temperature to effect rapid chloridization of the manganese, yet low enough to avoid chloridization of gangue materials. The reaction mass is leached, the leach solution evaporated, and the residue electrolyzed to free the manganese as metal and release the chlorine for re-use. H. S. Cooper, J. C. Schaefer and E. C. Schmidt, assigned to Walter M. Weil. No. 2,877,110.

As an improvement in the Betts Process of electrolytic refining of lead, a water-soluble extract derived by leaching the wood of western red cedar is added to the lead fluosilicate-hydrofluosilicic acid electrolyte. Use of this additive improves the quality and structure of the cathode deposit. G. H. Turner, assigned to Consolidated Mining & Smelting Co. of Canada, Ltd. No. 2,877,165.

Method and apparatus for sink-float separation of minerals of small particle size. N. L. Davis. No. 2,877,897.

Method for crushing and grinding ores in frigid weather, such as prevails in winter in the Lake Superior iron ore producing district, where ice forms on equipment and in the ore masses. The process entails early separation of the relatively finer material, which contains most of the water, from the larger particles and lumps of ore. J. F. Myers, assigned to Taggart & Myers, a partnership. No. 2,877,954.

Improved pyrometallurgical-hydrometallurgical process for recovering metal from sulphide ores, particularly porphyry copper or other copper sulphide ores. The contained copper is converted into cuprous sulphide by roasting, and the resulting calcine subjected to primary and secondary flotation steps to separate the cuprous sulphide. E. A. Sternfels, assigned to Continental Ore Corp. No. 2,878,102.

Process for smelting ilmenite and other titaniferous ores to recover titania and iron. Silica is used as the fluxing material, and the resulting slag has good workability and does not chill readily. M. J. Udy and M. C. Udy, assigned to SUMAC. No. 2,878,114.

To recover nickel and cobalt from laterite or other ore leach solutions, wherein the cobalt is in the cobaltic state, the solution is treated with NaOH under controlled temperature conditions. A practically cobalt-free nickel hydroxide precipitate is formed. This first precipitate is removed and washed. Further heating precipitates the cobalt. C. B. Bare and R. L. Clauser, assigned to Bethlehem Steel Co. No. 2,879,137.

Mr. North is patent consultant, Washington, D.C.

"Imagination... is the source of human improvement; experience its implement"

The giant new Copper Smelter of Kennecott Copper Corporation, Hayden, Arizona; designed, engineered and built by WKE.

MINERAL ENGINEERING: MAKING THE MOST OF THE EARTH'S RICHES

The measure of civilization's progress, through the ages, has been man's capacity to produce and put the earth's minerals to work for him.

Today, mineral engineering is a highly developed art based on knowledge and integration of techniques, processes, equipment—and economic feasibility; thus WKE's position of pre-eminence in the field. WKE experience covers virtually every economically significant mineral and metal. For example: selenium to iron ore; uranium to aggregate; 10 of the 25 U. S. uranium plants; 22 iron ore plants; 2 of the 3 recently completed copper smelters in the United States.

WKE's world-wide mineral engineering service can help you get more from a mineral deposit, from planning and execution of exploration drilling, test work and feasibility studies, through design and construction of mine, mine facilities and process plant.

We'll be happy to provide detailed facts on WKE's Mineral Engineering Services plus specific information on minerals or metals.

WKE ® WESTERN-KNAPP ENGINEERING CO.
SAN FRANCISCO • New York • Chicago • Hibbing
Building for the Future—in a World of Industries

Plan '59

To modernize now for growth and profits

Goes Into High Gear

In 1959, industry will spend more money than ever before to modernize its plant and equipment. But it is not spending enough to do the job that needs to be done.

Manufacturing companies* now plan to spend a total of $24.5 billion on modernization in the four years 1959-1962. This will be enough to replace roughly 70% of the obsolete facilities that were on hand at the beginning of 1959. But it will still leave us far short of our goal. It would take several years, at a higher rate of investment than is now planned, to wipe out obsolescence and give the U. S. a truly modern industrial plant.

These facts stand out from the 12th annual Survey of Business' Plans for New Plants and Equipment just completed by the McGraw-Hill Department of Economics. This new survey shows that industry has made a remarkable start on the modernization job that a previous editorial in this series described as "the most expensive task to be performed in America in this new year of 1959." The full cost of modernization has been found by the McGraw-Hill Department of Economics to be $33.3 billion for manufacturing, and $95 billion for all business.

For the past several months, McGraw-Hill publications have been devoting special attention to new developments in plant and equipment that offer opportunities for modernization. Our special effort to help industry in this regard has been called "Plan '59": to modernize *now* for growth and profits. This editorial will summarize the progress made so far with "Plan '59" and point out some of the areas where business and public policies can do still more to accelerate the modernization drive.

A Good Start

Business investment in new plant and equipment has picked up sharply since the low point of the 1958 recession. Plans for 1959 now show a 7% increase over 1958 for total capital investment. And the increase in expenditures for modernization is much sharper. Moreover, companies already have substantial plans for the years after 1959. New orders for industrial machinery, which are a good index of modernization plans, also are running well ahead of last year.

For the four-year period 1959-1962, manufacturing companies expect, on the average, to devote 65% of their plant and equipment outlays to modernization. This is the highest proportion reported in a McGraw-Hill survey since 1950. In dollar terms, manufacturing companies plan to spend $24.5 billion on modernization during the next four years.

This is an impressive figure, but it does not look so large when compared with the total need

*Excluding petroleum refining, which is reported as part of the oil industry in the data discussed in this editorial.

for modernization in manufacturing industries. As noted above, a previous McGraw-Hill study (conducted in August 1958) found that it would cost almost $35 billion to replace all the facilities that manufacturing companies then considered obsolete. Thus, present plans for modernization are enough to wipe out only 70% of the backlog of obsolete facilities by 1962—and this makes no allowance for the additional facilities that will be made obsolete by new machines and new processes introduced during the next four years. When these new developments are considered, present plans for spending may represent only half the job that will actually need to be done.

How To Accelerate

What can be done to accelerate the drive to modernize our industrial plant and equipment? Two of the greatest aids would be:

(1) Improve present provisions under the tax law for depreciation, to help industry retain more of the money it needs to carry out this massive job of modernization;

(2) Contain inflation, to preserve the purchasing power of the money industry sets aside to replace obsolete facilities.

At first glance, the supply of funds from depreciation allowances appears to be more than adequate. For manufacturing as a whole, depreciation allowances—the primary source of cash for modernization—will total $8.3 billion in 1959, compared with present modernization plans of $6.4 billion. Thus some extra funds will be available to support a further step-up in modernization in 1960.

Unfortunately, however, these depreciation funds are not evenly distributed from industry to industry, or from company to company. For example, in several of the metalworking industries, the prospective flow of cash from depreciation during the next four years is much less adequate than for manufacturing as a whole. These are industries with relatively large modernization backlogs, and they also are industries made up mostly of small or medium-size companies that have difficulty tapping the public money market.

As a result of these industry and company differences, there are many individual cases where shortages of funds limit the amounts of modernization now planned. In the McGraw-Hill survey, nearly half of all companies participating said that they would spend more on new plants and equipment if the depreciation allowances permitted by the tax law were increased substantially over the next few years. Most of these were relatively small companies. Their answers suggest that revision of the tax rules on depreciation should receive the most careful consideration as a spur to faster modernization.

The problem is complicated also by the threat of further increases in the national price level, which would necessarily include prices of capital goods. If "creeping inflation" resumes its march during the next four years, depreciation allowances based on present costs will be much less adequate for future needs. This points up the importance of national economic policies to maintain price stability. Unless this can be maintained, industry's dollars will not go far enough to do the modernization job that is needed.

Plan '59 Carries On

Industry's drive to modernize is now well underway. It can make a key contribution to our national strength and prosperity in 1959 and the years ahead. But the biggest part of this job is before us. It is up to the policy makers—in both business and government—to see that the job is done.

This message was prepared by the McGraw-Hill Department of Economics as part of our company-wide effort to report on opportunities for modernization in industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

THIS MONTH IN MINING *(Continued from p 21)*

Vaal Mine Begins Deepest Vertical Shaft–7000 ft

SHAFT SINKING has begun on what will be the world's deepest shaft at Vaal Reefs' gold mine in the Klerksdorp, Western Transvaal area. The twin shaft is expected to cost £5.6-million ($15.68-million).

In the course of the shaft sinking it is hoped that a new world record will be established. Russia now holds the record with 910 ft in a month. Vaal Reefs No. 2 will be precemented down to the 1,600-ft level at which point it will enter extrusive rocks. The ore-bearing reef is likely to be intersected at 4,900 ft and at 5,000 ft contact with the haulages approaching the area from the No. 1 shaft will be made.

A special small hoist will provide the answer to the hoisting problem. It is being equipped with 30,000 ft of cable. The concrete headgear for the new shaft is 165 ft high. It was constructed in 12 days using a continuous pouring method.

IMC Modernizes Carlsbad; Notes 50th Anniversary

INTERNATIONAL MINERALS & CHEMICAL CORP. will put more than $1-million worth of new mining equipment into operation during the next year at its Carlsbad, N.M., potash mine.

The new equipment, most of it designed to permit efficient operation in lower height ore beds than present equipment allows, includes: Low-height shuttle cars, low-height loading machines, a double boom jumbo drill designed to be used in low country, and a universal undercutter. In addition, $400,000 worth of new belt conveyors will be added to the system.

Operations in the potash basin are based on production from faces normally over 6 ft in height. When the ore bed is thinner, it is necessary to mine waste material enough to provide clearance for normal equipment.

Low-height equipment will permit efficient mining of ore beds as low as 4 to 5 ft and increase the ore reserves which can be profitable mined.

The equipment, some of which has already been received, is being installed on the sylvite level of the IMC mine, 900 ft below surface. This has been the basic ore of the Carlsbad basin.

LOUIS WARE, chairman of International Minerals & Chemical Corp., is credited with a major contribution to the firm's rapid growth since its incorporation in June 1909.

International, as well as a number of other companies, has acquired holdings in a vast deposit of high grade sylvite recently discovered in Saskatchewan, Canada. IMC is at present sinking a shaft and building a refining plant near the Canadian town of Esterhazy and plans to mine and refine muriate products from that bed.

Addition of new equipment at Carlsbad is part of IMC's plan to mesh the Carlsbad and Esterhazy operations "for maximum marketing effectiveness."

Above the sylvite ore bed at Carlsbad, IMC has two beds of langbeinite ore, at 800- and 850 ft below the surface. Langbeinite ore contains a double sulphate of potash and magnesia. IMC reports its Carlsbad mine is the world's only source of commercial supply of this ore.

Within the next few years, as the Esterhazy mine is able to take over supplying a portion of the demand for muriate of potash, the company plans to move part of the Carlsbad-low-height equipment to the langbeinite levels. While plans call for continued production of sylvite for years to come, increasing emphasis will be placed on langbeinite ore at Carlsbad.

Plans for the future include more stress on chemical production. Advance testing is now in progress on processes for handling enlarged tonnages of langbeinite and the possible development of additional chemical products from one or both ores from the Carlsbad mine.

Production of sylvite ore presently accounts for about three-fourths of the mine's total tonnage.

New Beryllium Unit

IMPERIAL SMELTING CORP. of London has joined with Beryllium Corp. to form a company that will produce beryllium metal for sale to fabricators both in England and on the Continent.

The new concern, Consolidated Beryllium Ltd., will operate a beryllium production facility at Avonmouth, England, now being completed by Imperial Smelting. The latter, a subsidiary of Consolidated Zinc Corp. Ltd., has been doing research and process development on beryllium for the U.K. AEC for six years.

Beryllium Corp. is a major supplier of the metal to the U.S. AEC, and operates production and fabrication plants of its own design at Reading and Hazelton, Pa.

(News continues on p 118)

Hanna's Groveland Starts Shipping Jasper Ore

WITH THE OPENING of the Groveland Mine, on Michigan's Menominee Range, the M. A. Hanna Co. has brought back to life a property with a long history and created a new 700,000 tpy facility. The mine, which had been mined between 1891 and 1913, was closed when the "jasper" could not be beneficiated profitably.

Today, 160 men are mining the tough ore at 30,000 tons per shift, and pushing it through a modern beneficiation plant where, after crushing and screening, it is cleaned, classified, ground, floated, thickened, dried and shipped.

With two tons of crude supplying one ton of concentrate, the mine works on a five shift week, according to the HANNA MINER, and the plant on a 21-shift basis. The mine will work year-round, shipping by rail or stockpiling during the winter.

The flowsheet is set up roughly as follows: Crushing begins with a primary gyratory, which provides a 6-in. product to the secondaries and screens. Product is minus five-eighths, with oversize being reground. Tertiary crushing takes place in front of six 3,000-ton storage silos, which feed two independent mill lines, with processing roughly as follows:

The mill lines start off with rod mills and screens in closed circuit: a product of minus 28 mesh going through rougher, cleaner and recleaner spirals and then to a drum filter. Drum filter product goes to shipping.

Spiral tails are treated further in a dewatering cyclone, with minus 100 mesh material going to primary and secondary desliming cyclones and oversize to a rake classifier in closed circuit with a ball mill. All minus 100 mesh then is deslimed and thickened.

Flotation begins with conditioners and goes through roughers, cleaners and recleaners; then to a concentrate thickener and disk filters. Waste is thickened, with makeup water reclaimed and waste to a pond. Concentrates are collected in the loading bin at the railroad loading site.

Now—more light, less weight, longer life with

NEW EDISON MODEL S ELECTRIC CAP LAMP

MSA announces another new *high* in lighting efficiency in the world's most popular cap lamp. Increased light output of the new Edison Model S Lamp assures greater safety for the miner, more tons per shift for the operator. Let's face a fact: Dimness costs money. *Fair* lighting does only a *fair* job. Maximum lighting—the brilliant, unfailing Edison Model S kind—helps get jobs done with top speed and safety. And the simplified method of charging new Model S Batteries—with the AUTOMATIC LOW-VOLTAGE SYSTEM—is convenient, thrifty and highly efficient. Lets miners take their lamps and rack them—quickly—without loss of time or waste motion. When planning a new lamphouse installation or modernizing your present one, call in the MSA Representative. MSA can help you solve your lighting problems.

Newly issued U.S. Bureau of Mines Approval 6D-31, April 16, 1959.

MSA SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY • 201 North Braddock Avenue, Pittsburgh 8, Pennsylvania
MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED • Toronto, Calgary, Edmonton, Montreal, Sydney, Vancouver, Winnipeg
MINE SAFETY APPLIANCES CO. de MEXICO, S.A. de C.V. • Mexico 4, D.F., Mexico

Look how small the headpiece is. Weighs only a few ounces. Feels even lighter on the head. You get a clear, sharp spot every time.

Increase in working light appeals to me. This new Edison Model S gives 15% more than we ever had before. And they didn't cut their bulb service life rating to do it. The double filament bulb means we'll always have working light to finish the shift. Each filament of the Edison Model S krypton-gas-filled bulb has a 400-hour designed life.

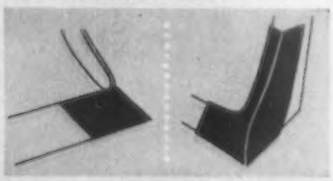
Just watch the improvement in our safety and tonnage reports. More light. Less weight. Longer life. Even the battery's better. It has a new active material that boosts service life. They went all-out to meet the miner's needs with this one.

Don't kid yourself! An extra half inch of wear on the cutting edge of your dirt-mover can cost you plenty! Wear that chews into the moldboard weakens it—especially around bolt holes. Then you may have to rebuild or even replace the whole works!

Renew or replace cutting edges and bits before moldboard wear starts. You'll be money ahead on repairs and 'way out front in dirt-moving efficiency.

ONLY THE BEST IS A BARGAIN!

Speaking of moving dirt, Allis-Chalmers really has the edge! Take dozers, for instance. Cutting edges and end bits are made of finest alloy steel, forged and electronically heat-treated in a process that deep-hardens working faces for extra-long wear, toughens the core to resist impact. For rock-dozing or worse, Allis-Chalmers makes *heavy-duty* edges, end bits and wrap-around end bits.



The man from your Allis-Chalmers dealer knows all about moldboards—for a new machine or reconditioning one you own—and the edges he recommends are *right*. Whatever you need, get original-quality Allis-Chalmers parts—*made for the machine*, best for the job.

move ahead with
ALLIS-CHALMERS
power for a growing world

THE OPEN PIT which has produced hundreds of thousands of tons of high grade magnesite, will be abandoned this summer when operations are changed to underground. An average of more than 6,000 tpm have been produced from the pit.

Nevada's Iron King Mine Goes Underground

THE IRON KING MINE, one of Nevada's largest producers of high-grade magnetite, is being converted from open pit to underground operation during the present season. It was also announced that G. W. Delamare, general superintendent of United Park City Mines Co., Salt Lake City, has accepted a partnership with Will Austin, owner and operator of the Iron King for the last several years.

The property lies 30 miles north of Jungo at an 8,000-ft elevation in the Jackson mountains of northern Humboldt County. A crew of 14 men are employed, and ore is trucked to the rail loading ramp at Jungo over a fine gravel road built and maintained by Austin. During the last several years shipments have averaged more than 6,000 tons per month; all of it to the Youngstown Sheet & Tube furnaces at Gary Ind., via Western Pacific railroad.

Large tonnages of ore have been blocked out for underground development, and production is expected to be continued at the same rate as heretofore. Charles Rowe, of Lovelock, is foreman in charge of mining operations.

Copper *(Continued from p 94)*

Because taxes on profits and other taxes on the mining industry, particularly outside U. S., are, and will continue for a long time to be an important part of the cost of operation, their increasing impact during the past ten years has been included in this tabulation. All market prices and cost figures are shown as the U. S. equivalent at then prevailing rates of exchange.

We have covered the ten-year period, 1949-1958, on a year by year basis. To avoid excessive cost variations peculiar to any one year, such as stepped-up development programs, strikes, or other items of abnormal costs, we have averaged the resulting figures by five-year periods, that is a moving average of each of the five-year periods ending in the years 1953-1958.

It would seem that an average price of 30 c will be sufficient to cover all operating costs and at the same time provide a reasonable margin of profit for most copper producers.

IN THE U.S.

ALASKA

A syndicate managed by Moneta Porcupine Ltd. of Toronto staked a new copper property last year and is now drilling. The prospect is located above Endicott Arm, between Juneau and Petersburg.

Bear Creek Mining Co. is drilling for the third successive season on the Ruby Creek copper show on Ruby Creek north of the Kobuk River near Shungnak. There is a crew of about 38 men on the property this year.

Two more areas have been designated by the U.S. Forest Service for the determination of surface rights on mining claims under P.L. 167 of July 23, 1955. These are in addition to many earlier areas within the Tongass and Chugach National Forests. Holders of claims staked prior to the date of the Act have 150 days from the starting date of publication to file verified statements if they wish to retain exclusive surface rights to their claims. The areas listed

EIMCO design and production PROGRESS REPORT

B - 395

Process Engineers, Inc., division of The Eimco Corporation: 420 Peninsular Ave., San Mateo, Calif.

World's Largest Covered Thickeners in Operation At U. S. Borax & Chemical

Four 230 ft. dia. Eimco-Process heavy-duty thickeners have been in operation for over a year at the United States Borax and Chemical Corporation refinery in Boron, California. These totally enclosed and insulated thickeners, largest of their kind in the world, are part of the CCD circuit from which the strong Borax solution goes to crystallization.

The thickener designs, developed in close cooperation with Pacific Coast Borax Division personnel and the engineering constructors, are custom-adaptations of Eimco-Process Type CX mechanisms. The cover of each unit is supported from radial trusses receiving central support from an 8 ft. dia. concrete column with steel shell that also carries the entire weight and torque of the thickener mechanism. The drive-head with split main gear and bearing was designed to the specific requirement of providing easy maintenance access. A special liquid seal was devised to protect the drive unit from tank vapors, as well as to ensure close control of process conditions.

Four totally enclosed Eimco-Process thickeners at Boron, California

Other installation features were the resting of the steel thickener tanks on oiled sand for corrosion prevention; continuous torque recording; and handling the thickener underflows with steam driven reciprocating pumps.

This $20,000,000 processing plant, on an 80 acre desert site, was designed and constructed by Southwestern Engineering Company and Ford J. Twaits Company as a joint venture. It has substantially increased the U. S. Borax capacity and is playing an important part in the production of high energy boron fuels for the space age.

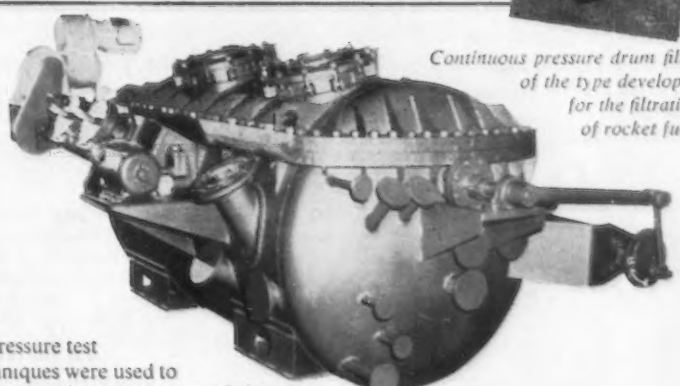
NEW BULLETIN AVAILABLE

We recently completed an eight page bulletin describing our thickeners, hydroseparators, air-lift agitators, reactor-thickeners, slurry mixers and related equipment. It also covers recent design innovations such as our unique Thixo arms and platform lifting devices, and should be in your reference library even if your immediate plans do not include thickening equipment. A request will bring one by return mail, or, if your plans *do* involve thickeners, our nearest sales engineer will deliver a copy in person.

Eimco Filtration Equipment Plays Important Role in Producing Rocket Fuels

At another plant, producing high energy fuels, engineers were faced with a troublesome filtration problem. They had to filter a fuel having an extremely low slurry viscosity, a high percentage of hydrogen in the gas, and containing a dangerously flammable material.

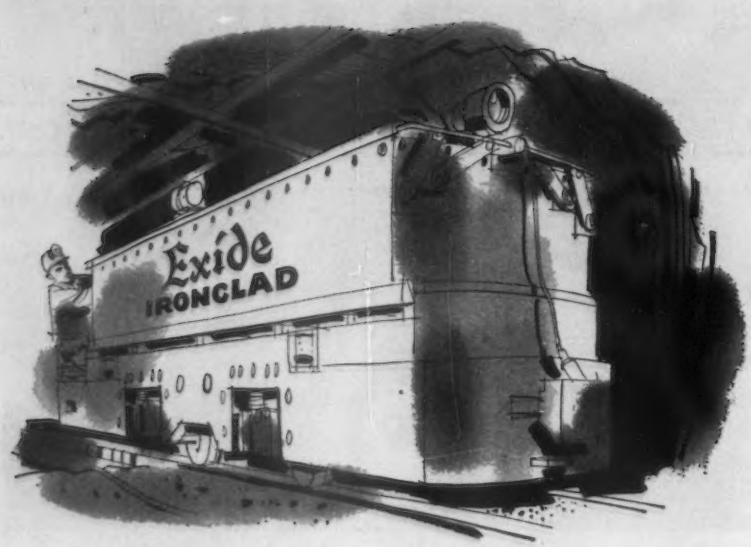
This problem was referred to Eimco's Research and Development center at Palatine, Illinois. Here, the Company's filtration research engineers, after a series of tests, were able to work out special adaptations for a continuous pressure drum filter that met all the specialized application requirements.



Continuous pressure drum filter of the type developed for the filtration of rocket fuels

Pressure test techniques were used to determine the correct size of the unit. Intricate seals were devised to keep air out of the pressure vessel. Changes were made in the hydraulic system. And, the filter was furnished with complete instrumentation.

This is typical of how Eimco's unexcelled research facilities and valuable backlog of experience in engineering custom-designed filter equipment can solve difficult filtration problems.



EXIDE-IRONCLAD BATTERIES

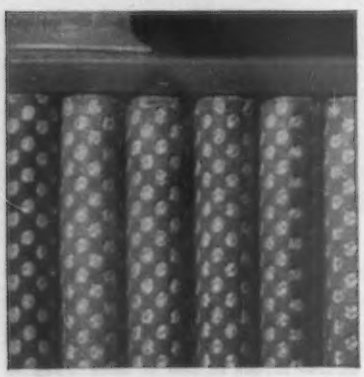
—best buy for the long haul

More ton-miles per dollar—that's the reason most cost-conscious mine operators prefer Exide-Ironclad Batteries for mine locomotives.

Experience has proved over the years that no other battery make matches Exide-Ironclad for average life in service and tonnage hauled. Rating for rating and dollar for dollar, Exide-Ironclad gives you more real value . . . more return on your investment.

Today's Exide-Ironclad features improved tubular construction, making it even better than the models that chalked up the industry's records. So you can expect even longer life potential and superior performance.

Total work output, not mere price, is the key to battery economy. When you buy batteries, specify Exide-Ironclad and get the most production capacity your dollar can buy. For details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



50 years ago, Exide patented the now-famous Exide-Ironclad tubular positive plate battery. For power and economy, nothing has ever matched it. Yet Exide engineers have constantly improved it. Today's battery packs more power, gives longer life and greater economy than ever before.

Exide®

Alaska *(Continued)*

are Granite Creek — Grandview and Grant—Ptarmigan Lakes.

Three Alaska land bills have cleared a legislative hurdle. A House Interior Subcommittee approved and sent to the full Committee bills which would:

1. Liberalize a statehood grant and permit Alaska to select about 25-million acres partially covered by mineral leases.
2. Increase from the present 100,000 acres to a million acres the public land an individual or company may hold under oil and gas leases.
3. Increase from the present 2,560 acres to 30,720 acres the maximum size of a coal lease on public lands.

COLORADO

Western Alloy Products Co., Grand Junction, Colo., has been sold to P. R. Mallory Co. for an undisclosed sum. Mallory's Indar Corp. will utilize the Colorado firm to sell tungsten carbide tool parts to the oil and mining industry.

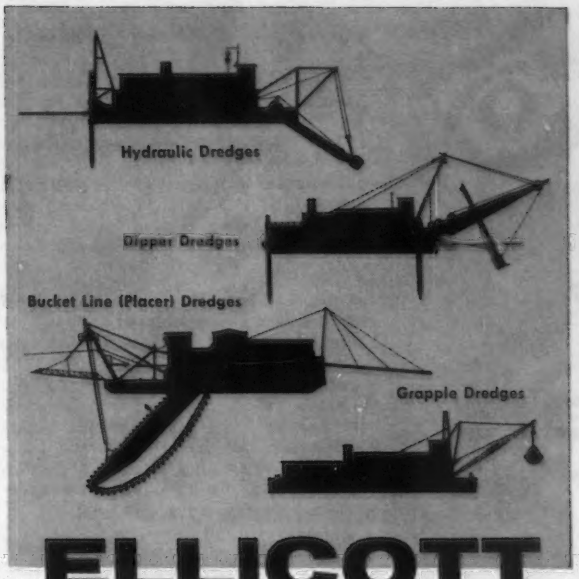
The Cotter Uranium mill at Canon City may shortly be allowed to expand from a 50-tpd pilot plant to a 200+tpd operation according to Jesse C. Johnson, director of the AEC Raw Materials Division. "We hope to have a contract signed shortly," Johnson said.

On April 2, 1959, the AEC recommended that the Colorado Front Range be given a 200-ton mill capacity. Other than the small Cotter operation at Canon City, there is no uranium mill now operating on Colorado's eastern slope.

Pre-fabricated steel plates will be used to build the portal at the Gold King Tunnel at Gladstone, one of Shenandoah Ltd.'s biggest projects to be undertaken at Silverton. A new 12-ton diesel locomotive is on the ground and will be transported to Gladstone when needed. It is 36-in. gage and by far the largest such power equipment ever to be used in the district. The rails to be used are 52 lb, comparable to those now in use by railroads.

The Happy Year Mine at Cripple Creek will be reopened in the near future, it was reported by C. H. Carlton. The Happy Year, located just below Observation Point on the Range View Rd. between Cripple Creek and Victor, has been leased by B. O. Bunner of Colorado Springs. Bunner formerly operated the Amanda Mine, in the vicinity of the Happy Year. Bunner and his associates operate as the Three B Mining Co.

In Clear Creek County, crews are at work developing orebodies in both the Big Five and Lucania tunnels. A new exhaust fan has been installed at the Big Five which will speed the crosscut work. Kenneth Waggoner and Felix Moretti will drive the Rouville tunnel for Ernest Hoffman at his property in the Red Mountain district. Road conditions have made transportation and building of a power line difficult.



ELLICOTT

KNOWS DREDGES LIKE YOU KNOW MINING

May we share our experience?

When your mining problems are dredging problems, we can help you solve them.

For nearly 75 years, Ellicott engineers have designed and built dredges best suited to the needs of the job. With this experience we can make unbiased recommendations on any type or size of dredge so that you will get the right one for your project.

Ellicott engineers are specialists willing and able to undertake thorough preliminary investigations during the early stages of any contemplated mining-dredging operation. This enables us to suggest the most economical dredge for your project. We can furnish any type of mechanical or hydraulic dredge equipment or special combination of units you may need. *Of course, all studies and recommendations are made in the strictest confidence.*

Ready supplies of spare parts and expert field engineering service are always available to keep equipment in top operating order. By consulting Ellicott, you get the benefits of dealing with *one* company, with an undivided responsibility for the performance of all equipment.

3020

For full information on Ellicott dredges and dredging equipment for mining, write to

ELLICOTT MACHINE CORPORATION

1633 Bush Street, Baltimore 30, Md.

525 Market Street, San Francisco, Calif.

Subsidiaries: Dragues Ellicott France, Paris, France; Ellicott de Mexico, Mexico City, Mex.; Dragas Ellicott do Brasil Ltda., Rio de Janeiro, Brazil; Ellicott Fabricators, Inc., Baltimore, Md.; McConway & Torley Corp., Pittsburgh, Pa.

Successors to the floating dredge business of the Bucyrus-Erie Co. and the American Steel Dredge Co. Complete engineering sales and repair parts service.

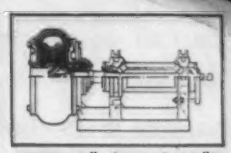
LINATEX

LASTS LONGEST

Linatex Lined
Linatex Designed

CENTRIFUGAL

PUMPS



(SIZES 1" through 12")

DURABILITY PLUS

...by using the same longer lasting LINATEX that adds 5 to 8 times to the life of conveyors, chutes, launders, hoppers, etc.

COLD BONDED—JOB SITE APPLICATION

For information and quotations please write:

LINATEX CORPORATION OF AMERICA

P.O. DRAWER "D", STAFFORD SPRINGS, CONN.

du Verre

RESIN BONDED FIBER GLASS CONSTRUCTION SOLVES ANOTHER CORROSION PROBLEM

Design engineers planned for trouble-free, corrosion-free operation at this metal refining plant. They know the waste gases containing a high concentration of free wet chlorine and other highly corrosive elements would make short work of metal or rubber lined components. That's why they specified the really dependable, corrosion-free du Verre #22 for all parts of the ventilating system —collectors, vent pipes and venturi exhausters.

Since duVerre construction is equally resistant on the outside, painting or other maintenance operations are not required. Field assembly, installation and erection are accomplished at minimum cost.

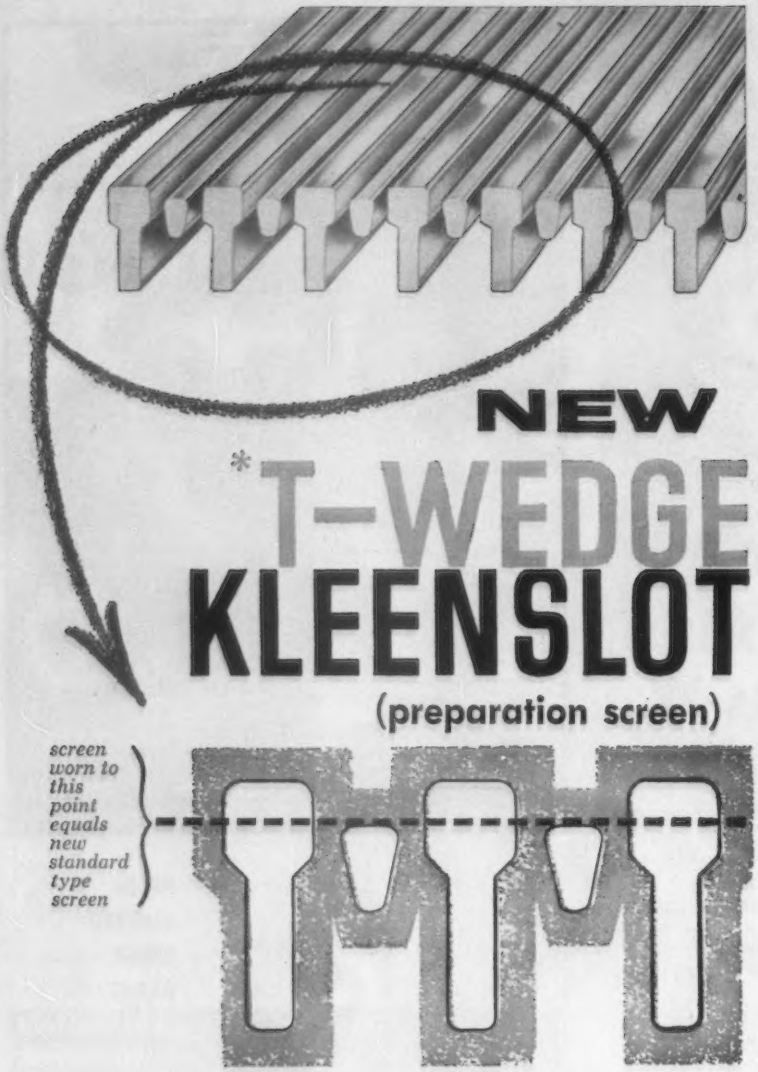
Learn all the money saving features of corrosion-resistant duVerre construction.

Write for your free copy of Bulletin #7.

du Verre Inc.

duVerre, Incorporated

Box No. 37-B, Arcade, N. Y.



"T" and "WEDGE" wire combine to create the ultimate in...

GUARD BAR DESIGN–high "T" profile wire between every wedge shaped wire performs as guard bar *and* screen

GUARD BAR ECONOMY–new design effects added screening surface, small screen efficiency with large screen life

with *I. F. A. *independent flexing action for non-blinding, non-clogging performance*

new T-WEDGE screen is especially adaptable for flumes or vibrator applications—can be easily interchanged with other types of Kleenslot screens without mechanical changes—abrasion resistant stainless steel

FOR ADDITIONAL INFORMATION . . . write

WEDGE-WIRE CORPORATION
Wellington, Ohio

*patent applied for

Colorado *(Continued)*

W. N. Monson, of Denver Golden Oil and Uranium Co., is ready to begin a road to the property in the Clear Lake basin. The project had been held up until the Forest Service gave approval to the survey. A tunnel will be driven in some 1200 ft and raises driven to connect with highgrade gold-bearing quartz veins prospected at the upper outcrop last year.

Work has been in progress for several weeks on a new crosscut tunnel in Boulder County being driven on the property of Coliowa Uranium Corp. The portal of this tunnel is in James Creek Canyon and will be driven approximately 1600 ft to open a pitchblende orebody, which has been proved by a diamond core-drilling program. This tunnel will open the orebody approximately 300 ft below the upper workings.

Changes and additions at Oil Shale Corp.'s Denver area pilot plant, 3350 S. Zuni Street, have now been completed, Herbert E. Linden of Beverly Hills, Calif., president, has announced. The finished plant, said to be completely automatic in its operation, has been started and will continue for a four-month run. It is now equipped, Linden said, to make large-scale, one-ton-an-hour tests of all the steps in the Swedish Aspeco process for producing oil from oil shale.

A Denver oil company reports it has struck a vein of highgrade gold ore in the Bald Eagle Mine it operates in Virginia Canyon near Central City. Paul R. Clark, president of Jackpot Oil Co. said the new vein was developed 110 ft below the old workings. A 69,000 lb concentrates shipment from ore taken from the new tunnel of the Bald Eagle Mine showed 52.2 oz gold per ton, 43.15 oz of silver, 20.15% lead and 1.0% copper on the 35-ton shipment.

IDAHO

Hecla Mining Co. has made arrangements with the Bunker Hill Co. to mill silver-copper ore from the Bunker's Crescent mine at the Polaris mill of the Hecla Co. L. J. Randall, president of Hecla, said the pact will enable his company to keep the Polaris mill in operation and take care of decreasing tonnages from the company's Silver Summit mine. Milling of Crescent ore will be on a custom basis, Randall said.

J. C. Kieffer, manager of the northwestern mining department of the American Smelting and Refining Co., reports that sinking of the main shaft at the company's Galena mine near Wallace, has reached a point about 90 ft below the 4000 level, where a skip pocket has been started. He said the company has completed drifting to the east on the Silver vein on the mine's 3700 level for the time being and that drifting westward has started. Kieffer also reported

AIR SURVEYS SPEED MINING EXPLORATION AND DEVELOPMENT

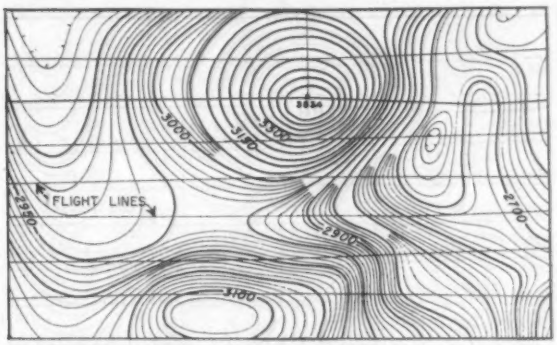
How new aerial methods
cut costs, save time
from first exploration to
final staking of railroad centerline

Air surveys are saving time and money in exploration and development of modern mining properties.

First use comes in the prospecting stage. The most important new aerial exploration tool is the Aero/Newmont electromagnetic detector, used in the search for sulphide ores. It measures both in-phase and out-of-phase EM signals, and a magnetometer record is made at the same time. The correlated information high-grades the ground targets to be studied, says Aero Service Corp., Philadelphia.

Both magnetometer and EM detector are helicopter-borne. This permits tree-top level surveys, following closely the shape of the land, in searches for lead, copper, and zinc.

A more widely used exploration tool is the airborne magnetometer. Since Aero made the world's first mineral survey in 1946, it has flown nearly 3,000,000 miles with the sensitive Gulf instrument.



Magnetic peaks such as these were picked up in air survey over previously unknown iron ore body.

Equipped with electromagnetic detector, magnetometer and scintillation counter, this helicopter has been busy on many surveys in the Far North and other Canadian areas.

One survey turned up the now famous Marmora ore body. Another major iron ore find was uncovered in eastern Pennsylvania at a depth of 1,500 to 3,000 ft. Survey cost: 7 cents per acre.

Other surveys include the Allard Lake project in Quebec, to define area of possible ilmenite deposits—and searching for new nickel deposits in Canada. Aero surveys also helped to uncover Quebec Cartier's iron ore deposits in northern Quebec.

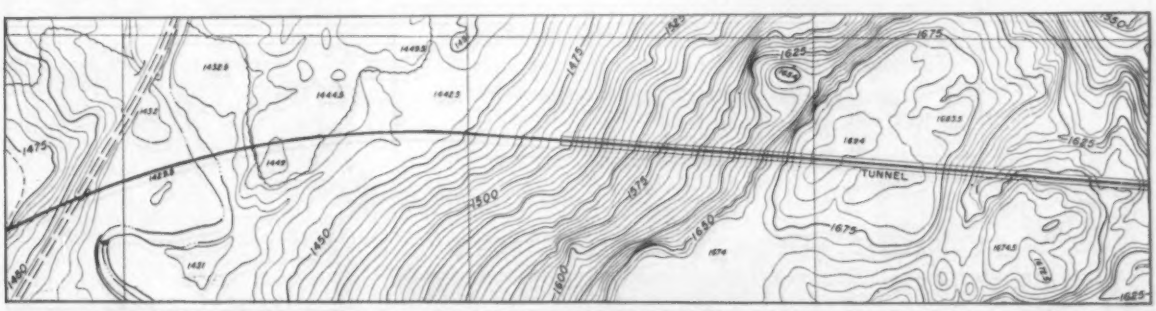
Around the world, Aero crews are completing surveys in Thailand, Korea, Laos, Venezuela, Union of South Africa, and the United Kingdom. Doppler radar, newest navigational aid, will be used to guide a new search over South American jungle.

Other air surveys help to plan and locate mining communities. At Elliott Lake, photo interpretation provided information about soils, timber, and potential fill areas. Topographic maps were compiled for engineering planning and construction.

Pre-engineering surveys for Quebec Cartier helped to locate its 192-mile railroad and stake its center line. More, it provided soils studies and topo maps for two town sites, a hydroelectric plant, a harbor and a concentrating plant.

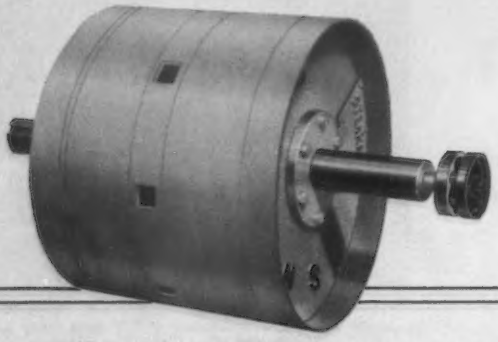
Another railroad project performed by Aero called for final location maps, plus center line staking over 75 miles of swampy, brush-covered terrain. Surveying, mapping and location work were completed in 1½ years for Erie Mining Co.

Information about Aero's broad services may be obtained by writing AERO SERVICE CORP., 210 East Courtland St., Philadelphia 20, Pa. Ask for new literature concerning exploration and mapping.



This map—5 ft. contours, 1"=200 ft.—aided final location of Erie Mining's railroad.

For Tramp Iron Removal or Cobbing Magnetic Ore



A MINING MAN'S ELECTRO-MAGNETIC PULLEY

Stearns electromagnetic pulleys are engineered to the exacting demands of the most critical mining man. Size for size, Stearns pulleys are the most powerful in the industry; they're rugged; they're top quality in every respect. By reputation, these are the finest electromagnetic pulleys you can use — and over the long pull, the lowest cost.

2-Coil for Tramp Iron

For most effective tramp iron removal, Stearns 2-coil pulleys produce a magnetic field that's deepest at the center of the conveyor belt — where the load is heaviest. Actually, smaller, lower cost 2-coil pulleys can be used on many jobs without changing standard conveyor practices for belt speed, loading, etc.

Multi-Coil for Cobbing Magnetic Ore

For ore concentration, Stearns multiple coil pulleys produce a magnetic field of uniform depth that conforms to conveyor loads on such operations. Stearns' experienced magnet engineers will work closely with you on selecting pulleys for mining applications — or on any other of the complete range of magnetic equipment Stearns builds for the mining industry.

NEW FREE PULLEY BULLETIN

A new bulletin describing the Stearns electromagnetic pulley line is yours on request. Write for Bulletin 1011-D.

STEARNS MAGNETIC PRODUCTS

A DIVISION OF THE INDIANA STEEL PRODUCTS COMPANY

635 SOUTH 28TH STREET • MILWAUKEE 46, WISCONSIN

Idaho *(Continued)*

repair work has been completed on damage caused by recent rock burst in the mine.

R. W. Neyman, president and general manager of the Federal Uranium Corp. of Salt Lake City, reports the company has completed its shaft sinking at the Conjecture mine on Pend Oreille lake in Idaho and, he said, drifting is now underway, six days per week, toward an objective on the 1000 level of the mine.

A new flotation mill is being constructed by Lucky Friday Silver-Lead Mines near Mullan. The company, one of the newest major producers in the Coeur d'Alene mining district, is investing more than $800,000 to build the mill and a new surface plant to replace the existing one. The 400-tpd capacity mill will handle all production from the nearby Lucky Friday mine when completed later this year.

Currently, Lucky Friday ore is being processed at the Golconda Lead Mines mill. A new conveyor system is being constructed to bring ore from the skip pocket at the top of the shaft. Ore will be brought to the mill through an inclined raise and the conveyor belt will drop it into a 600-ton ore bin. From there it will drop down to the crushing plant and ball mill. New facilities include a machine shop, mine office and warehouse. Production at the mine is being stepped up to be ready for the new plant. Employment at the Lucky Friday mine is now 125, compared with 50 on Jan. 1. Work on the new mill started May 1.

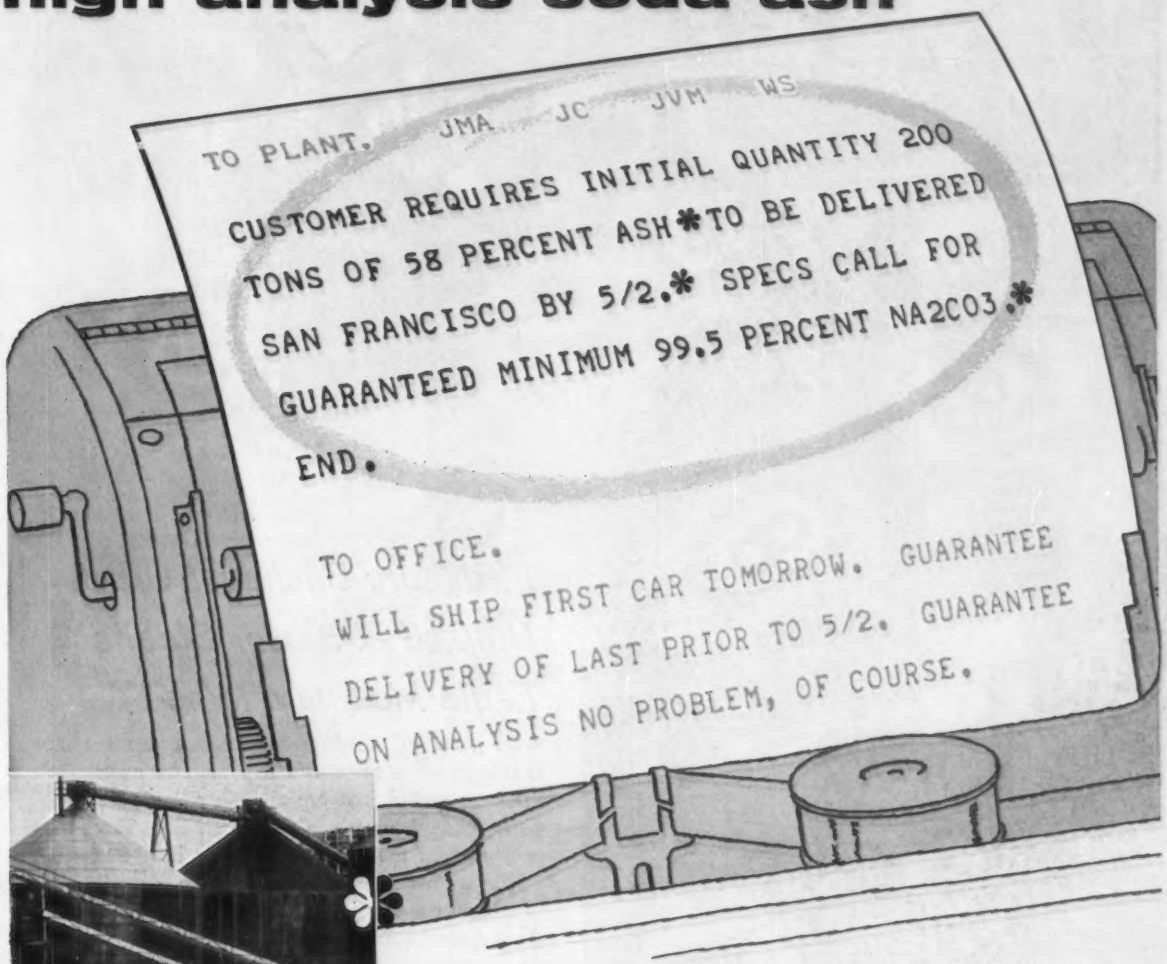
Hecla Mining Co. is continuing its development work in the Rainbow area of its Silver Summit operations west of Wallace, Ida.; and in addition a crosscut is being driven from the Rainbow workings southerly into the so-called Triangle area, which is a group of claims owned or controlled by Day Mines, Inc. and Asarco, to intersect structures which may exist south of the Polaris fault in northern Idaho. Under a working agreement Hecla would own 70% of any production which might result from this work, Hecla President L. J. Randall reported.

The mining industry of Idaho has sent a check for $250,000 to the board of regents of the University of Idaho to match a similar appropriation of the Idaho state legislature for construction of a new school of mines building at the University.

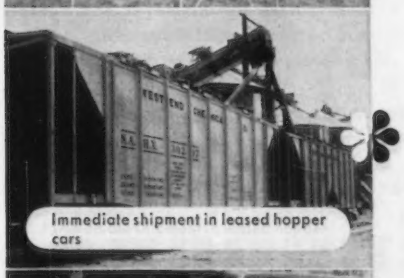
Ore production at Asarco's Jack Waite mine in the remote Idaho-Montana divide area north of Wallace has been stepped up this year. First quarter production was about 4,000 tons, or about 16,000 tpy. compared to less than 10,000 tons mined in 1958.

Metal production from mines of the Coeur d' Alene district totaled 1,212,321 tons in 1958 and the gross value of the output was $34,061,394, according to annual reports of 21 mining companies and six leasing operations filed in the

West End "fills the order" for high analysis soda ash


TO PLANT. JMA JC JVM WS
CUSTOMER REQUIRES INITIAL QUANTITY 200 TONS OF 58 PERCENT ASH*TO BE DELIVERED SAN FRANCISCO BY 5/2.* SPECS CALL FOR GUARANTEED MINIMUM 99.5 PERCENT NA2CO3.*
END.
TO OFFICE.
WILL SHIP FIRST CAR TOMORROW. GUARANTEE DELIVERY OF LAST PRIOR TO 5/2. GUARANTEE ON ANALYSIS NO PROBLEM, OF COURSE.

Storage for 25,000 tons of industrial chemicals


Immediate shipment in leased hopper cars

Constant control for uniformly high quality

Meeting service requirements to the letter and producing superior soda ash of consistently accurate particle size and chemical analysis are the essentials to which the West End organization is uniquely geared. A system of rapid communications linking our sales office in Oakland with our production, technical and shipping departments at the desert plant site permits each department head to have a complete understanding of the customer's individual requirements and to make firm commitments or provide the desired information promptly.

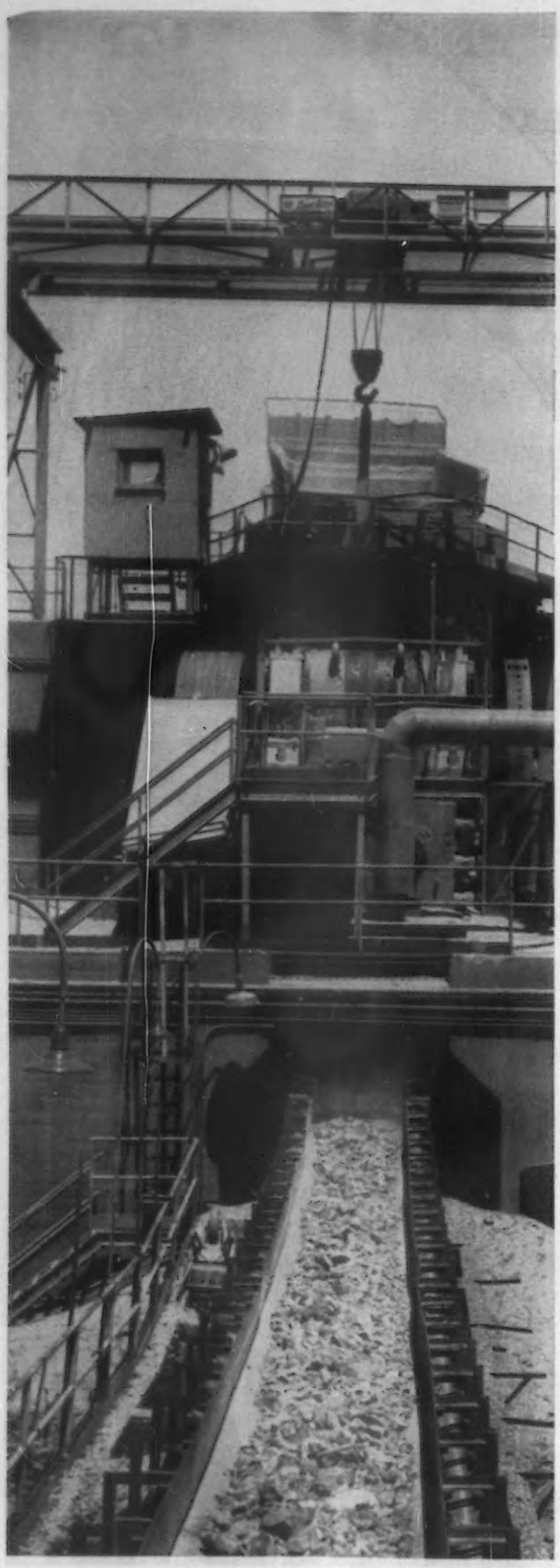
WEST END

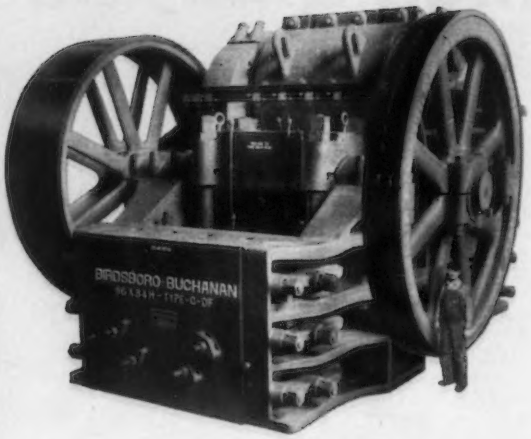
Stauffer

WEST END CHEMICAL COMPANY

DIVISION OF STAUFFER CHEMICAL COMPANY

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIF. • PLANT, WESTEND, CALIF.





Birdsboro-Buchanan Crusher Utilized at Kaiser Steel's Eagle Mountain Mine

• A giant 66″ x 84″ Birdsboro-Buchanan crusher is being used to meet current production quotas for primary crushed iron ore at Kaiser Steel Corporation's Eagle Mountain, California, Mine. The iron ore will feed the West Coast's only blast furnaces.

The crusher is of an advanced deep-frame design with longer swing jaw for faster crushing to small sizes. A Birdsboro representative can tell you about the progress of this crusher installation, as well as hundreds of others, many in operations just like yours.

Sales Department, Engineering Department and Mfg. Plant: Birdsboro, Pa., *District Office:* Pittsburgh, Pa.

Canadian Representative & Manufacturer: John Inglis Co., Ltd., Toronto, Canada.

World-Wide Agent Representation. Contact home office for nearest representative.

CR 23-58

BIRDSBORO

STEEL FOUNDRY AND MACHINE CO.

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design ROLLS: Steel, Alloy Iron, Alloy Steel

Idaho *(Continued)*

County assessor's office in Wallace. Both figures represent 11-year lows for the industry and compare with an extraction of 1,491,584 tons of a gross value of $41,212,944 in 1957. Bunker Hill mine was the leading producer followed by Bunker Hill Co.'s Star Mine.

Miners and prospectors of the Grangeville area recently organized a protective association at Grangeville in a move to preserve mining claims within national forest boundaries. The Forest Service had proposed certain withdrawals of land from all forms of appropriations under U.S. mining laws, pointing to need of sites in forest areas for recreational, camp and picnic uses.

MICHIGAN

One of the worst accidents in Michigan's long mining history occurred at the Sherwood mine at Iron River June 1 at 9 am. It resulted in instant death for four men, hospitalization for seven and less serious burns for others. One of the seven died 10 hours after the accident and another later. Reino Anderson, Iron County mine inspector, reported his findings on June 15. "After a thorough investigation in the place of the accident and from first hand reports from the men involved in the accident, I have the following conclusions: 'A large quantity of water from the surface had accumulated above the old stopes. The pressure and weight of this water caused a passage to break through the sand, gravel and rock; and this water, upon coming in contact with the hot sulphurous slate, (formed steam which) forced its way into the ventilating system on the 12th level, while some of it forced its way to the surface via the shaft.

"This steam and vapor, along with a large amount of hot, burning dust, caused the instantaneous death of four men on the 12th level." (The four bodies were found at distances of from 370- to 800-ft from the shaft.) "Two men died later in the hospital from third degree burns. Six men suffered first and second degree burns and several men were treated for dust in the eyes and superficial burns on hands and face. I am not inclined to believe that there was a collapse of a pillar (as some thought at first) because such collapse would have created a wind of greater velocity that would have been capable of moving small objects that would have been in this level, and was not the case. There was no evidence of a fire because no signs of scorching were found on powder boxes, electric wires, etc. These are my conclusions on this accident up to this date."

A doctor said that the injured men were burned by temperatures of from 500 to 1,000 degrees. One survivor said "it was like sticking your head in an oven and closing the door." An editorial comment in the Iron River Reporter said: "No inspector could have foreseen

Got A Tough Digging Job?

• SOFT GROUND

• DEEP WATER

• NARROW SPACE

• STEEP HILLS

Use A Sauerman DragScraper

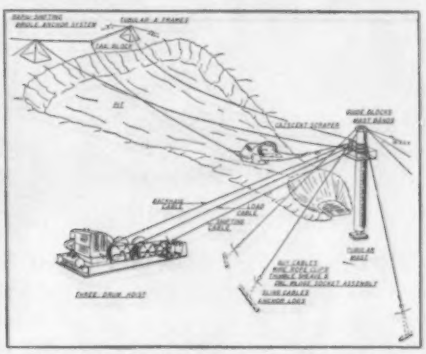
• **SOFT GROUND**—Sauerman DragScrapers work on surfaces where wheeled equipment cannot go and where mats are required to operate a dragline. The DragScraper digs and hauls its load quickly at ground level to hopper or pile. It carries a payload of two to three times its weight. You are not paying the power costs of a heavy machine with a handling capacity that is just a small portion of its weight.

• **NARROW SPACE**—A DragScraper can be operated through an opening no larger than the bucket's width. They are used successfully in culverts, sewers, tunnels, under bridges and buildings. Locations with limited space and head room . . . unworkable with other equipment . . . are handled efficiently and economically with a DragScraper.

• **DEEP WATER**—A Sauerman DragScraper will dig as much as 100 ft. below water . . . this is far below the safe depth that a dragline bucket can go without the danger of undermining and overturning the machine. Use a DragScraper for trenching, digging channels, lakes or for beach construction.

• **STEEP HILLS**—These are routine for a DragScraper. Material can be taken from anywhere on the bank. Digging from the top of the slope eliminates cave-ins—and the DragScraper gives an extra bonus by pushing additional material in front of the bucket on its way down the slope.

The Sauerman DragScraper operator and hoist is always located away from any hazardous area. It is designed for years of safe, continuous duty, handling bucket sizes up to 15-cu. yds. over spans to 1000 ft. or more.



THE SAUERMAN METHOD—*showing a basic DragScraper installation. Variations of this method are Sauerman engineered to handle the toughest digging jobs at the lowest cost per cu. yd.*

When you have a "tough-to-handle" job consult Sauerman engineers about Sauerman equipment and the Sauerman Method. Request Catalog A, also the Sauerman News and field reports.

SAUERMAN BROS., INC. 626 SO. 28th AVE. BELLWOOD, ILL.

Crescent Scrapers • Slackline and Tautline Cableways • Durolite Blocks

To save time . . .
Every Tool Box Needs
a compact, easy-to-carry

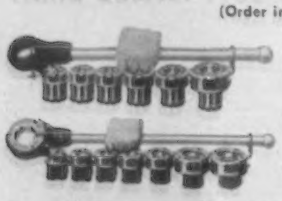
RIDGID®

Drop Head Threader Set

Snap a die head in the ratchet ring . . . cut your thread! It's as simple as that with a RIDGID drop head threader. Heads can't fall out . . . dies reverse quickly for close-to-wall threading. Finest quality RIDGID long wearing dies. Conduit dies available.

Call Your Supply House!

Hand Carrier Free With All Sets Except No. 12-R
(Order in sets or any combination)



Exposed Ratchet Type
For pipe: ⅛" to 1"—00-R; ⅛" to 1¼"—111-R; ⅛" to 2"—12-R
For bolts: ¼" to 1"—00-RB

Enclosed Ratchet Type
For pipe: ⅛" to 1"—0-R; ⅛" to 1¼"—11-R

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

Michigan *(Continued)*

Monday's cave-in, even if he had patrolled the mine an hour before. We have had competent mine inspection by county inspectors for many years. The Sherwood mine had gone 10 months without a single lost-time accident." There were 40 men underground at the time of the accident and 28 were removed safely. Some of the men who escaped severe injury saved their faces from being burned by covering them with jackets or other articles of clothing. Stockpile loading was resumed at the mine June 8 and regular underground work June 15 after the accident area had been thoroughly closed off.

Pickands, Mather & Co. is now operating five mines on the Gogebic range—the Sunday Lake, Geneva, Cary, Peterson and Newport. The Buck mine on the Menominee range, closed in July 1958, was reopened in April of this year; and the Volunteer open pit on the Marquette range has opened its 1959 season. It shipped 41,741 tons in 1958.

Cleveland Cliffs Iron Co., has built a plant at Eagle Mills for beneficiating some of its Marquette range underground ores. It has facilities for drying, crushing, screening and sizing and a heavy media unit. Also at Eagle Mills the company has constructed a large research pilot plant to supplement its research laboratory at Ishpeming. An agglomerating plant for treating the concentrates from the Republic jasper mine produces pellets for shipping.

MINNESOTA

Erie Mining Co., operated by Pickands, Mather & Co., is now producing taconite pellets at about its designed capacity rate of 7½-million tpy. PM&Co. is also operating the Embarrass, Scranton, Mahoning, Bennett, Danube and Tioga No. 2 pits on the Mesabi range; and the Mahnomen and Rabbit Lake on the Cuyuna range.

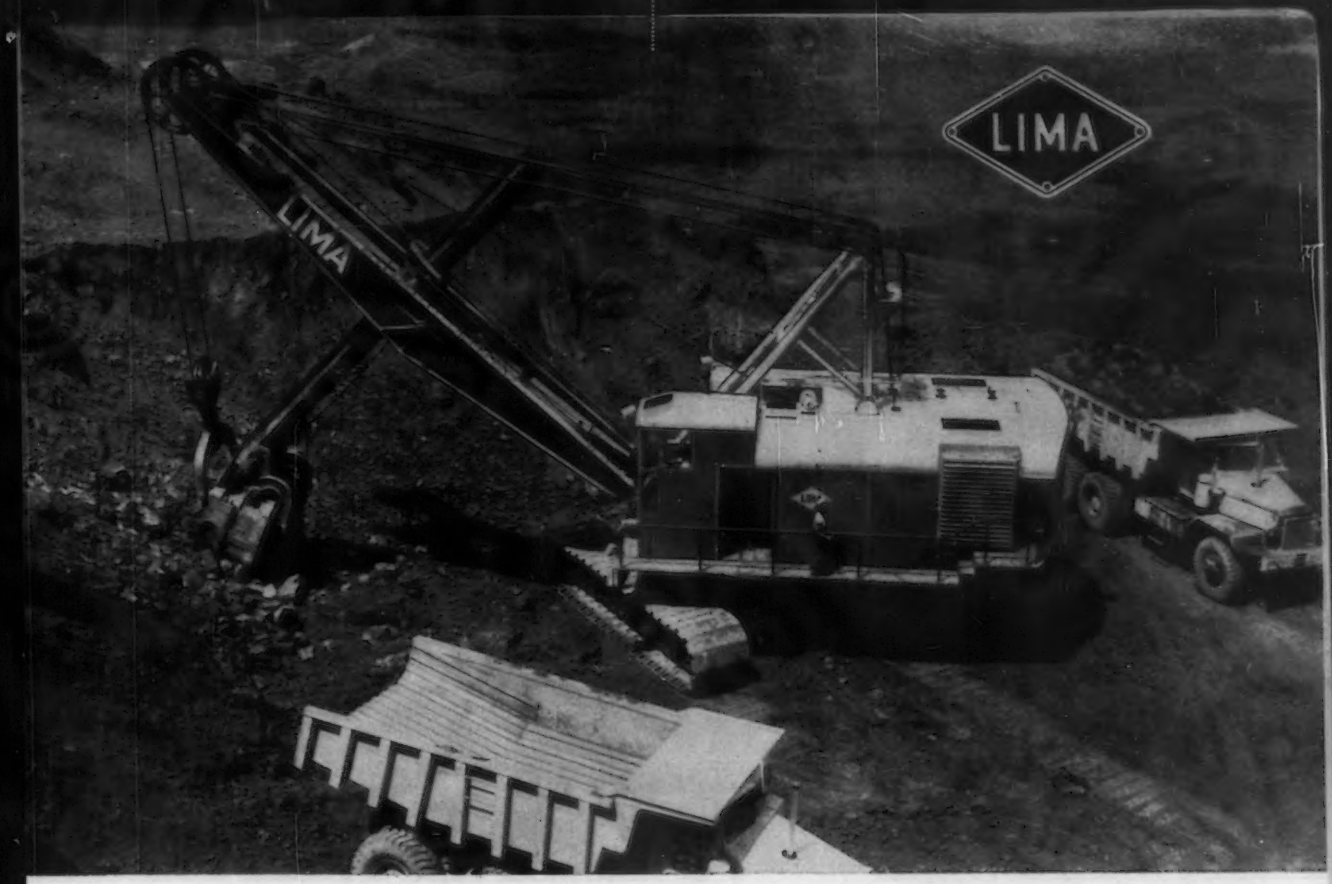
Interlake Iron Corp., Cleveland, will build a plant at Chicago, to be completed in 1960, to produce 3,000 tpd of self-fluxing sinter. The sinter will be used in its two furnaces in Chicago.

MONTANA

Anaconda Aluminum Co. will increase operations at its aluminum reduction plant at Columbia Falls, to 88% of capacity, equal to an annual rate of 57,000 tons. The plant has been operating at 75% of capacity since July 1.

Yogo sapphire mine in central Montana has ended three decades of idleness with production of 75 tph of milling ores. The mine operators are reported planning to operate until October.

The mine, in Judith Basin County near Utica, was opened at the turn of the century, and closed in 1929. The original company was formed in 1898



Powerful Lima 2400, with big 6-cu. yd. dipper, excavates and loads iron ore high on this mountain in Venezuela.

Now show more profit... put Limas on jobs demanding high output, low cost!

Limas tackle the toughest jobs the world over. And the biggest and toughest of all the Limas is the Type 2400, a convertible 6-cu. yd. shovel, 110-ton crane, and variable capacity dragline.

Maintenance 5 cents an hour

One operator says, "... Our Lima does more work and costs less to maintain than other makes of similar capacity ... in about 6000 hours of rugged stripping operations, maintenance and parts have amounted to less than $300 —actually less than 5 cents an hour. Seems as if you just can't wear a Lima out!"

All major operations on the 2400 are accomplished by air-actuated clutches. Its diesel engine is equipped with torque converter to reduce shock loading and eliminate engine stall. Converter gives operator smoother, more accurate control for faster swings. Longer booms and handles can be added for high-lift shovel work.

No matter what your job requirement, there is a Lima exactly right for your needs. Limas are built throughout for heavy duty service. If you want to strip, dig or load more ... at a lower cost, compare quality before you buy and you will choose a Lima! Cranes to 110 tons, shovels ½ to 6 cu. yds., draglines variable. Choice of power plants and crawler, truck or wagon mountings.

To get full information on the Lima that will profit you most, see your Lima distributor today—or write to us.

Lima Type 604 loads Minnesota iron ore with 1½-cu. yd. bucket on 23-ft. boom, 18-ft. dipper handle.

DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD

LIMA Construction Equipment Division, Lima, Ohio

BALDWIN · LIMA · HAMILTON

5915

Shovels • Cranes • Draglines • Pullshovels • Roadpackers • Crushing, Screening and Washing Equipment

BALDWIN BLH LIMA-HAMILTON

Montana *(Continued)*

by several London jewelry merchants.

Montana Supreme Court, in a 3-2 decision, has ruled that failure to record a verified location notice on a placer mining claim does not necessarily deprive the claimant of his vested interest in the location.

NEVADA

After two years of development work, W. J. Baker and Joe McKenzie, of Lovelock, and Earl Simpson, of Winnemucca, are now producing mercury ore from their mine in Pershing County. Located on the Freckles Claim 30 miles east of Lovelock, the property produced cinnabar several years ago, but had been shut down for some time. The present leasers have an upright retort, crusher and hoist on the site, and are living in two trailers and a cabin.

Sulphur Products Co. is producing eight flasks of mercury and one carload of sulphur per day at its properties near Sulphur in western Humboldt County. H. C. Crowfoot, co-owner of the property, says cinnabar ore is being taken from a vein estimated to run about three miles long and to extend over a width of 500 ft. The firm is now in the process of erecting a 300-ton plant purchased from the Wah Chang Corp. at Gabbs, and which is expected to double its production of mercury. Sulphur is taken from a mine near the cinnabar property and requires no upgrading for shipment to California commercial plants.

A decision to resume mining activities on the historic Comstock Lode has been announced. The extensive local properties of the Consolidated Virginia Mine, where in 1874 MacKay and Fair struck the bonanza orebody that has been described as the largest deposit of precious metals ever found on earth, have been leased for 10 years to the Consolidated Virginia Mining Co. The announcement was made by Abraham Kendall who, with his mother Bell E. Kendall, owns the claims, and Francis H. Knighton, president of the mining company.

Nevada Minerals & Oil Corp. has purchased the Tonopah Belmont Mine and adjoining North Star and Montana group of mining claims near the Nye county seat, according to John W. Derr, president. The Tonopah Belmont, which produced $38-million in gold and silver early in the century, has been operated by Nevada Minerals & Oil Corp. for the last several months on a lease agreement. Shipments of ore to the U.S. Milling & Minerals Corp. mill at Silver Peak are being made at the rate of 100 tpd, but plans call for the erection of a 200-ton milling unit at Tonopah for concentration of silver, gold and selenium ores.

Development work is progressing steadily at the Silver Queen mine, on the west slope of the White Mountains in Mineral County. The silver property is at an elevation of 7,600 ft in Queen's Canyon mining district and is connected to nearby Highway Six by a good gravel road.

Shipments of barite ore from the Jumbo mine in the Ellendale district of Nye County started in June. The property is owned by Chemical & Pigment Co., of Oakland, Calif., and crude ore is shipped to their plant as a paint additive. Wells Cargo Inc., carried out the preliminary drilling program, and has contracted to do the hauling.

Kenard Mining & Milling Co. has started operating a 50-ton concentrating mill at Gabbs, recently purchased from A. W. Rischmiller. New owners are Dr. Paul C. Goddard and Gerald S. Kennedy, of Gabbs. They are milling previously mined lead-silver ores from the San Rafael mine at Quartz Mountain, 20 miles from the mill. Louis Gordon, executive secretary of the Nevada Mining Assn., is owner of the San Rafael property.

Kennecott Copper Co.'s million-dollar skip haulage system went into operation during June and is expected to cut costs in half at the Liberty Pit west of Ely. On tracks descending nearly a quarter

LAS VEGAS, the site of the 1960 American Mining Congress, has completed construction of its new convention center, a $6-million facility which can seat 8,000 persons. The new structure is topped by a 312-ft dia dome, which covers a circular assembly hall 240 ft in dia and an outer display concourse. Exhibit halls, meeting rooms and kitchens flank the main structure. Metal was supplied by Reynolds Metals Co., construction by Apex Steel Corp.

of a mile into the pit, each skip carries 25 tons of ore to the crest. Capacity of the new system is 1,000 tons per hour with round-the-clock operation planned.

Eagle-Picher Co., during June, completed drilling a well at its Pershing County mill and reports a flow of 300 gpm. The water has a temperature of 140 degrees and will be used to carry waste from the mill to the sump.

Core drilling operations were started in June at the Sanderson Kendall mining claim five miles northeast of Goldfield. Drilling followed stripping and surface work carried out by Jim Reid of Los Angeles, who recently acquired the property. Andy Hampton, of Burbank, Calif., is in charge of the drilling. Plans call for several 100-ft exploratory holes. Reported discovery of platinum ore in commercial amounts is credited with being the basis of the development program.

U.S. Gypsum Co.'s mill at Kodak, five miles east of Lovelock, is producing a steady output of upgraded perlite under direction of Ted Wisti. Ore mined by skiploader at the company's property west of the Pershing County seat is trucked to the mill for treatment. The finished product is shipped by rail to U.S. Gypsum's plant at Empire in northern Washoe County where it is popped to make it of insulation character.

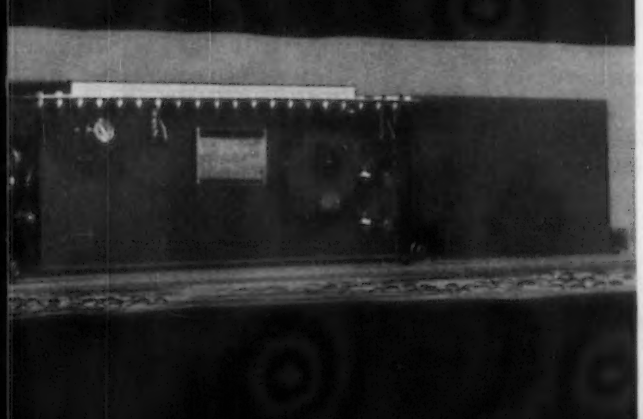
NEW MEXICO

Homestake Mining Co., San Francisco, has purchased a substantial interest in some McKinley County uranium mining properties of the Lance Corp. Lance is a wholly-owned subsidiary of Sabre-Pinon Corp. The agreement gives Homestake approximately a 25% interest on 1,280 acres in the Ambrosia Lake area. Homestake will finance approximately 25% of the work, including construction of surface facilities, necessary to put a 600 tpd mine into operation. Total investment for Homestake will amount to more than $1.3-million.

TENNESSEE

After seven months of explorations, diamond drillings and testings, Tennessee Copper Co. of Ducktown has begun dewatering and retimbering the Silver Hill Mine, on a 700-acre tract 10 miles

FROM GENERAL ELECTRIC...



"LO-BOY"

D-c power at 30% lower cost

General Electric's "Lo-Boy" portable silicon rectifier provides you with a new, more economical source of d-c power for mines, even thin seam mines. Here's why:

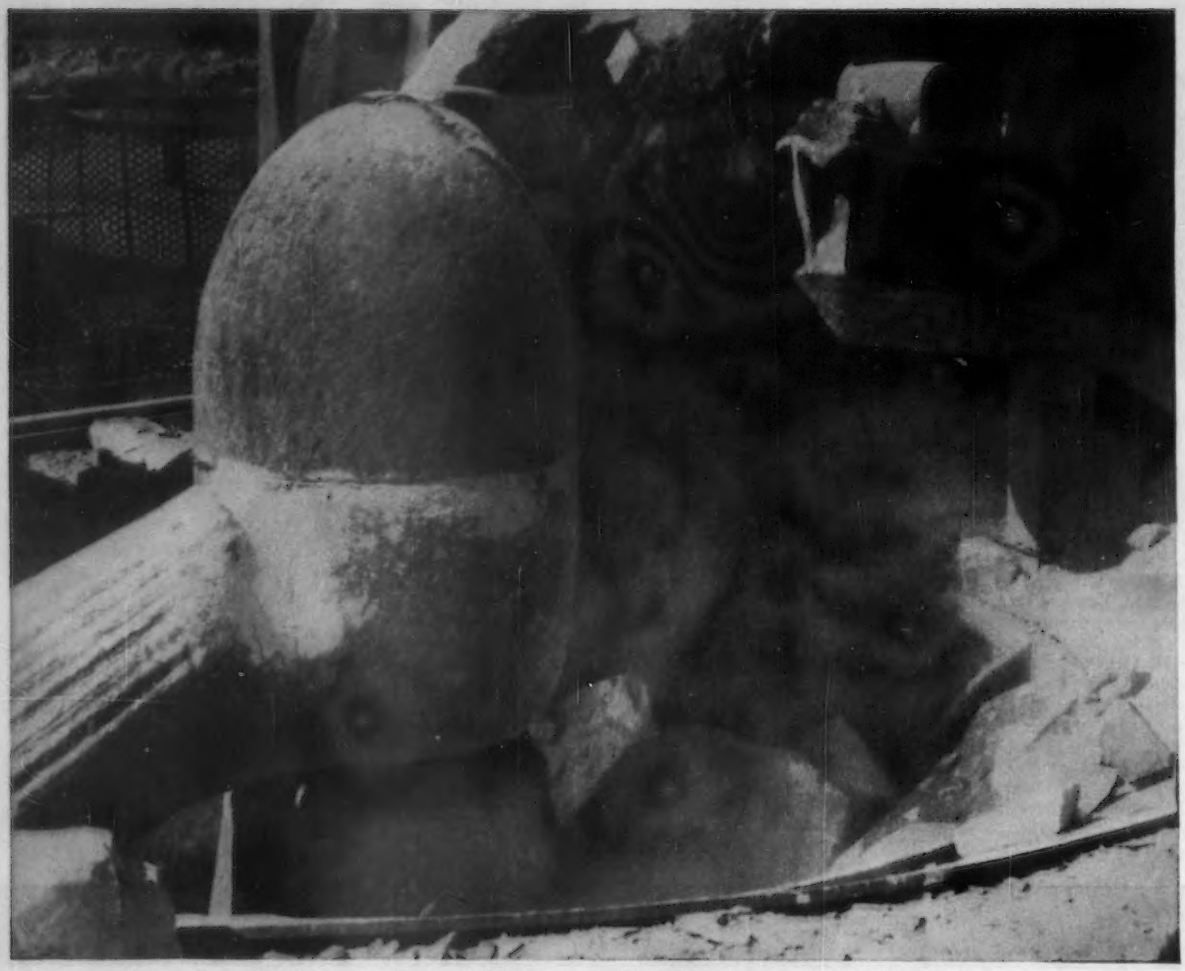
- **Low Initial Cost.** "Low-Boy" is priced about 30% less than mercury-arc rectifiers;
- **Requires Less Maintenance.** Except for cooling fans, there are no moving parts to wear out;
- **Easy Installation.** Sealed-dry transformer is one-half the weight of liquid-filled transformers. Rectifier car is 30% lighter than mercury-arc. Either car can be lifted by either end for easy handling.

Thirty-inch height makes "Lo-Boy" especially valuable for your present and future low-seam operations. New low height and two-car design provide approximately double the kw capacity in the same space required by other conversion means.

The equipment operates unattended. All live parts are enclosed. It's available in ratings from 300 to 500 kw, 275 and 300 volts d-c.

For more information, contact your G-E Apparatus Sales Engineer, or write to Section 532-1, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC



Crushers like this — fitted with Ni-Hard concaves — are turning in impressive service records at Spencer Quarries, S. D. They crush Sioux Quartzite, which, like Taconite, is among the hardest known minerals . . . and it has a compressive strength of over 100,000 psi.

NI-HARD crusher concaves outlast manganese steel 3 to 1

At Spencer Quarries, Spencer, South Dakota, Ni-Hard* concaves in 6-inch crushers, have lasted three times longer than manganese steel rings in the throat area, where compression forces are highest.

In a 30-inch gyratory crusher at Spencer, Ni-Hard bottom ring concaves are in their third year of service—where previously the best manganese steel rings wore out in six months. All of Spencer's Ni-Hard concaves were supplied by Brom Machine and Foundry Co., Winona, Minn.

Whether crushing quartzite at Spencer or working tough Taconite on the Mesabi Range, economical Ni-Hard nickel-chromium cast iron is proving better able to resist abrasion and high compression forces than any other material.

Ni-Hard concaves are available from authorized producers throughout the country. For the address of the one nearest you, write to Inco.

*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall St. INCO New York 5, N. Y.

Looking down the throat of a gyratory crusher. Concaves in the important lower ring are of long-lasting Ni-Hard.

NI-HARD

NICKEL MAKES ALLOYS PERFORM BETTER LONGER

Tennessee *(Continued)*

southeast of Lexington, N. C., which was a source of lead for Confederate bullets from 1861 to 1864.

New Jersey Zinc Co. is reported to have bought the Joe Cline farm (600 acres) at New Market for $95,000. The farm has been under option for three years while New Jersey Zinc prospected the area with aid from a DMEA loan.

UTAH

International Oil & Metals Corp. is stepping up its uranium mining operations as a result of having substantially expanded the orebody on its property in the Big Indian district, Gordon C. Holt, president, announced. He said the company is now producing uranium ore at the rate of $75,000 a month, or at an annual rate of $900,000. A proven reserve has been indicated of 1-million tons averaging .50% U_3O_8 and a probable proved reserve of about 2-million tons.

New Park Mining Co. proposes a major three-dimensional geophysical reconnaissance of the Park City District, according to W. H. H. Cranmer, president. Other operators in the lead-silver-zinc district, which has produced more than $500-million in values since the 1870's, will be asked to participate, Mr. Cranmer told annual stockholders meeting at The Homestead, near Midway.

The program, he said, would be undertaken upon completion of present explorations in the Mayflower mine, where a 6,000-ft exploration tunnel is being pushed westward on the 2,200 foot level. This $800,000 project, in which DMEA shares interests, is now in 500 ft. It seeks copper mineralization.

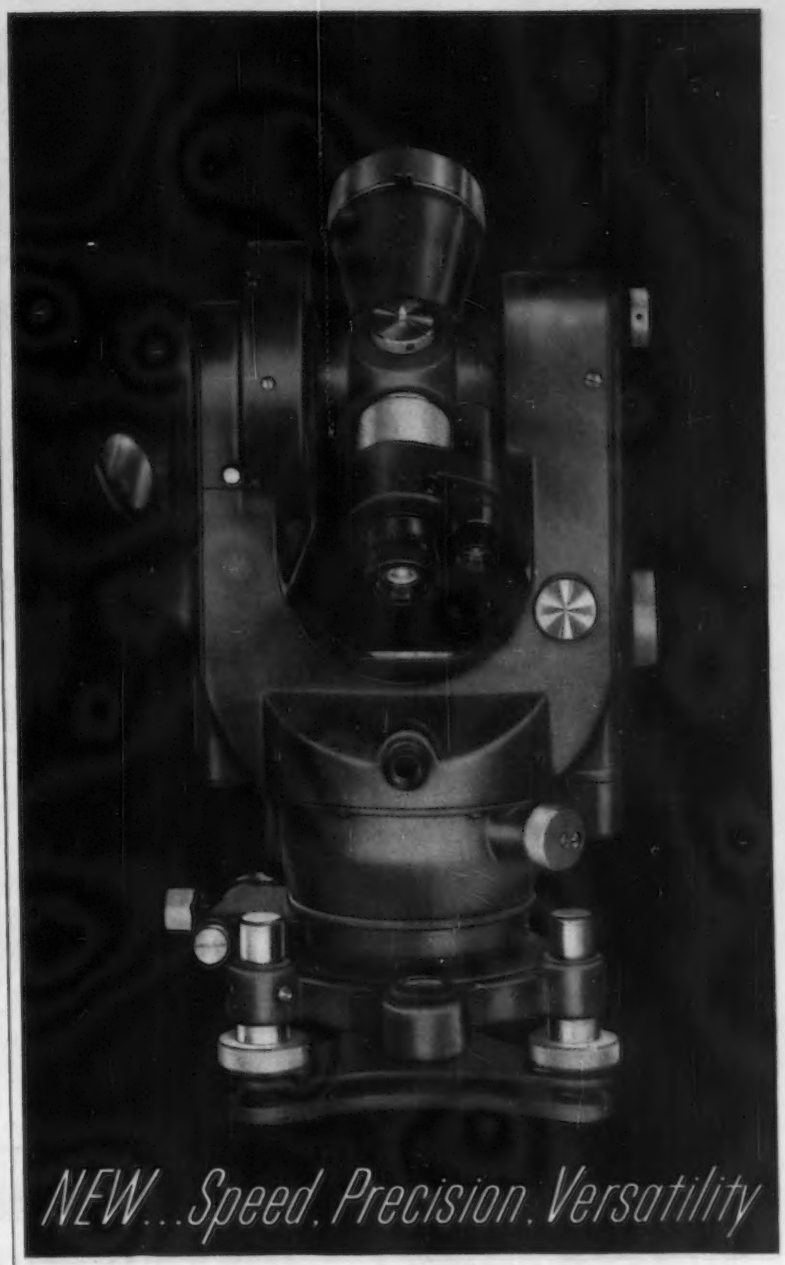
WASHINGTON

Mudhole Exploration Co., Spokane, reported that timbering work is underway at its mine shaft in the Mount Spokane district. Officials said that a hole drilled into the wall near the bottom of the 75-ft shaft indicated some highgrade autunite ore.

Daybreak Uranium, Inc., Spokane, is experimenting with ore upgrading equipment at its open pit mine on the Dahl lease in the Mount Spokane mining district. The company said the initial installation consists of a shaker and 1-in. screen. The shaking action is expected to break off the autunite coating on rock material. Some uranium material will be washed off. Daybreak is continuing shipments of ore to the Dawn Mining Co. processing mill at Ford.

WYOMING

Natrona County commissioners will be-



WILD T-1A OPTICAL REPEATING TRANSIT

All the ruggedness, simplicity, and trouble-free performance of the world renowned T-1...plus the convenience and extra speed of automatic vertical collimation setting.

Vertical angles can be read immediately after set-up. No need to center vertical circle level...no cleaning or maintaining moving parts.

Highway, mining, or any other surveying project, day or underground, becomes routine with the Wild T-1A.

Upper and lower motions for setting on zero and for repeating. Built-in optical plummet.

Write for Wild Booklet T-1A.

In Canada: Wild of Canada Ltd., 157 Maclaren St., Ottawa, Ontario

WILD®
HEERBRUGG
INSTRUMENTS, INC.
Main at Covert St. • Port Washington, N.Y. • POrt Washington 7-4843
FULL FACTORY SERVICES

Scientists Focus On "The Undiscovered Earth"

WITH THE WORLD'S EYES turned upward to rockets, monkeys and space exploration, a group of top scientists met in Birmingham, June 11 and 12, to look the other way—into the earth's crust. On the podium were impressive names and faces such as A. B. Kinzel, vice president, Union Carbide, and Edward Teller, director of the University of California's Livermore laboratory.

In the audience were executives and research heads from many of the nation's leading mining, oil and chemical companies, plus notables in fuel research, metals development, and kindred fields.

The program, sponsored by Southern Research Institute, was headlined, "The Undiscovered Earth." As one Southern research scientist explained the title, "The IGY is over. We're holding this meeting to summarize accomplishments of IGY, and speculate on where we go from here."

The keynote speaker, Dr. Kinzel, told the group that the conference was called "to take a look at the portion of the world that we live in, without being inhibited by any sense of immediacy."

Kinzel stressed importance of keeping a "time perspective" to ward off false conclusions as to man's relation to the sources of power in the earth's crust.

The Carbide executive said "The Paley Report was excellent as far as the facts it set forth are concerned. But further assumptions and conclusions were made, indicating we were in for a dire shortage of iron, lead and zinc. But there's more known iron ore today than there was at the time of the report, and lead and zinc markets are glutted."

Admitting that someday, in the distant future, man might be forced to turn to new sources of metals and minerals, Kinzel said that man's ever-improving equipment would see him through. Kinzel cited the airborne magnetometer, and the Geiger counter as examples of such advancements. "Then too, there's oceanography. Manganese nodules on plateaus in the South Pacific test 28% MnO_2. Today, manganese has to be 48% to prove really interesting, but if we run out of high grade, we may go after these South Pacific deposits.

"But I see no prospect of our running out of anything. We used to consider copper a unique product, largely because of its electrical conductivity. Now, aluminum is widely used for its role in conducting electricity.

"Who's to say that we shouldn't run our future motors in a bath of liquid nitrogen? Engineers tell me I'm crazy—but the advantages are manifold."

At the dinner meeting, Dr. Edward Teller used movies, blackboard sketches, and straight podium-talk in an hour-and-fifteen-minute talk on peaceful uses of the H-bomb. Among Teller's fondest near-future hopes—

1. Excavation: Blowing, with five simultaneous shots, a harbor on the norhwest coast of Alaska. "Big explosions will cost only 2c per cubic yd for earth removal. We can handle the job if someone wants such a big hole. We have hopes for this Alaskan shot to be completed within two years. If it comes off, it will be quite a show."

2. Uncovering minerals: "For a small cost, we could remove 200 ft of earth. This would expose deep-veined materials for cheap strip-mining."

3. Oil: "In the Athabascan region, oil heated to the boiling point flows like water. Our dream is to try an explosion underneath the oil level. The explosion would break up the material, then liberated heat from the explosion, or forced hot water, would bring the oil up. If this experiment is successful, oil in Athabasca will be as rich as oil in the Near East."

4. Power source: "We need to find a way to store this tremendous power. One way might be to heat salt, with an explosion, then bring the energy up in an agent such as water, or nitrogen. A power plant on such a site would operate about a month. Then another underground explosion would be necessary. We need to design a reusable explosion chamber."

5. Chemicals from explosions: "Potassium aluminum sulphate breaks down to potassium sulphate at 650 degrees. An explosion could break down the aluminum so that the potassium sulphate could be washed up to ground level. This would furnish a tremendous supply of this material for fertilizers."

Another high point of Southern Research Institute's program was a talk on the "Deep-Hole Project," by Gordon G. Lill, head of the office of Naval Research's Geophysics Branch.

Lill said barge-drilling over the deep ocean to depths of 30,000 ft below sea level may begin sometime in 1961. Initial phase will cost $1.6-million. Total cost of the big hole—$10- to $15-million.

Possible drilling sites are a high rise north of the Puerto Rican Trench, and a Pacific Ocean site near Guadalupe Island.

N. C. Dezendorf, general manager of General Motors Electro-Motive Division, announced that his company would lease $1-million worth of equipment to the drilling project, for a payment of $1, for an indefinite period.

M. King Hubbert, geology consultant for Shell Development Co., gave the conference some remarkably specific predictions as to future supplies of fuels.

Coal: "Projecting the coal-production curves for the world into the future, a culmination in the consumption of coal should occur about 200 years hence."

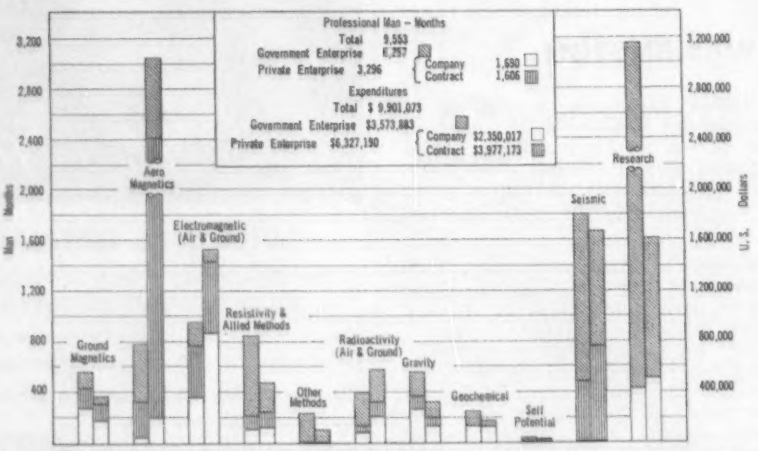
Oil: "It appears that the peak of world production of crude oil should occur about the year 2,000 and that for the U.S., not too far from 1965."

Natural Gas: "The peak of gas production will probably occur near 1970."

Hubbert said the solution to problems of dwindling fuel reserves will depend on utilization of nuclear energy. "Geological studies indicate that rocks with an energy content equivalent to 1,000 barrels of oil per ton of rock occur in such abundance that energy from this source is hundreds of times greater than that of all fossil fuels in the world.

Another possible source of industrial energy, said Hubbert, is fusion of the light isotope, deuterium, into helium.

"If this reaction can be made to proceed in a controlled manner, the energy obtainable from one gram of water would be about three-quarters of that obtained from one pound of coal.



PROFESSIONAL PEOPLE engaged in world-wide mining geophysics during 1958 numbered 796 compared to 598 in 1957 and 503 in 1956. Total expenditures in 1958 were $9,901,000 compared with $11,530,000 in 1957 and $10,266,000 in 1956. Total geophysical activity was reduced 7.7% in 1958 compared to 1957 with seismic, gravity and magnetic explorations reduced during 1958, while use of other methods increased significantly. Asia led the field in geophysical activity followed by Europe, U.S., Africa, Canada, Australia and South America. Expenditures, ranked in decreasing order, were made in Africa, U.S., Europe, Asia, Canada, Australia and South America. Chart is courtesy of Society of Exploration Geophysics.

New Ford F-100 4-wheel drive Styleside pickup handles heavy loads and makes its own road.

Now from FORD...America's lowest-priced 4-wheel drive pickups... *Six or V-8!*

ALL FORD-BUILT . . . FACTORY-ENGINEERED . . . FOR GREATER SAVINGS!

Go *Ford*-ward for 4-wheel drive performance at big Ford savings. They're factory-engineered for extra stamina, and all Ford-built with your choice of economical Short Stroke power—Six or V-8.

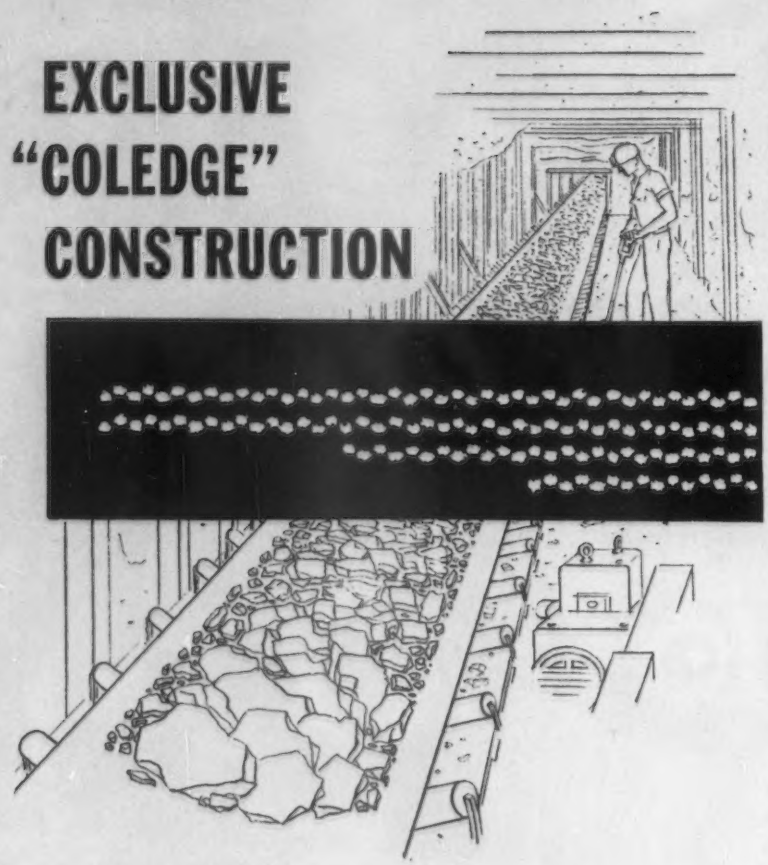
There's new versatility too, with two power take-off points in the transfer case to drive winches, saws, diggers, or other equipment. And there's new driving ease. You shift smoothly between 2- and 4-wheel direct drives while moving.

Ford 4-wheel drive trucks are available in ½- and ¾-ton pickups, chassis-cabs and ¾-ton stake models. See your Ford Dealer . . . save hundreds of dollars on America's lowest-priced 4 x 4's with Six or V-8!

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . LAST LONGER, TOO!

EXCLUSIVE "COLEDGE" CONSTRUCTION



Quaker Thermoid gives Conveyor Belting extra life where it counts

Punishment at the edges—especially the tough use dealt out in mining—can kill most conveyor belting in a fraction of the lifetime of Thermoid-Quaker Conveyor Belting. The unique "COLEDGE", though, available on all grades of Thermoid-Quaker Belting, puts more rubber where it's needed, makes a more flexible and wear-resistant edge where abrasion is greatest. Tests show Thermoid-Quaker Belting with "COLEDGE" construction lasts and lasts on the same jobs where other belting fails.

What's more, all Thermoid-Quaker Conveyor Belting is *prestressed* in manufacture, so that the belt is actually in compression when you get it—ready for the heaviest load without strain.

Examine Thermoid-Quaker Conveyor Belting with the exclusive "COLEDGE" construction at your Thermoid distributor's, or write for further information to *Thermoid Division, H. K. Porter Company, Inc., Tacony & Comly Sts., Philadelphia 24, Pa.*

THERMOID PORTER DIVISION

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Copper and Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY DE MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

Wyoming *(Continued)*

gin work immediately on a $100,000 program to improve the road from Casper to the Gas Hills area, where Globe Mining Co. is building a new uranium processing mill. Globe is building the mill 75 miles west of Casper. The road to be improved is from Waltman, 26 miles to the Natrona County line. Globe recently signed a contract with the AEC for purchase of the uranium concenrate (see E&MJ, June 1959, p 23). The mill will have a capacity of 492 tpd.

Western Nuclear Co.'s uranium mill at Jeffrey City was shut down at midnight June 11 because of an overproduction of concentrated yellow cake. Robert W. Adams, company president, said it was not known how long the mill would be idled. He said the mill has a stockpile of yellow cake which will meet present contract needs of the federal government. The AEC recently authorized Western Nuclear to increase its capacity from 440 to 845 tpd and the firm last month negotiated a $6-million loan to finance expansion of the mine.

San Francisco Chemical Co. has acquired control of the entire west limb of the Crawford Mountain syncline, a phosphate operation west of Kemmerer. The Crawford Mountain phosphate structure is located five miles south of Leefe, extending south some eight miles, culminating at Rex Peak, about four miles due east of Randolph, Utah. San Francisco Chemical Co. said the move assures the company reserves in the Leefe area for more than 40 years.

Susquehanna-Western, Inc. has contracted to purchase uranium ore from the Gas Hills properties of Vitro Minerals Corp., for processing at its new mill here. Total purchases under the contract may exceed $15-million. The agreement, which was announced by Allen D. Gray, president of Susquehanna-Western, Inc., and Charles J. Potter, president of Vitro Minerals Corp., calls for the delivery of ore containing 480,000 lb of uranium concentrate per year from Vitro's mines in the Gas Hills area, and provides for shipments to the end of 1966.

IN CANADA

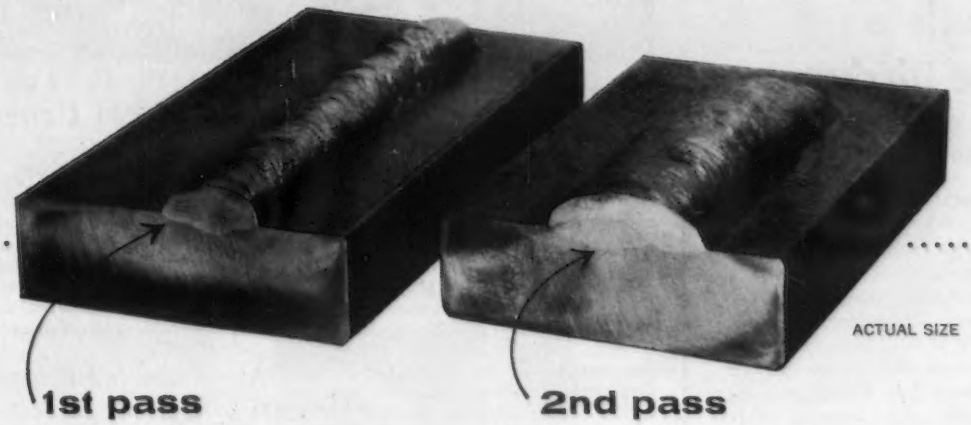
BRITISH COLUMBIA

Bethlehem Copper Corp. Ltd. reports its $2.5-million underground sampling program (see E&MJ, May 1959, p 156) will be completed in September, and expects shortly thereafter to announce its Highland Valley production plans. The annual report indicates that a minimum production rate of 10,000 tpd is planned, with a smelter and possibly a refinery.

Rio Tinto Mining Co. of Canada will launch a search this year for copper-magnetite and porphyry-copper deposits in B.C. (see E&MJ, July 1959, p 19)

STOODY BUILD-UP

(Iron Powder Coating)



Compare the new Stoody Build-Up with any other material of this type. It gives you:

SPEED.....15% to 50% faster deposit rate

BUILD-UP.....Higher—with sound deposits

ECONOMY.....High welding efficiency gives lower cost per pound of deposit

WELDABILITY.....Stable arc—low spatter—less smoke

OTHER FEATURES....Higher tensile strength—low crack sensitivity—excellent machinability

Use Stoody Build-Up for

- Shafts (to be machined)
- Gear Teeth
- Sprockets
- Tractor Rails
- Churn Drills
- Build-up on carbon steels for hard-facing overlay

See your Stoody dealer for complete information (check the Yellow Pages of your phone book) or write to

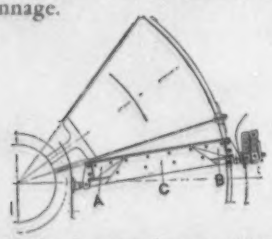
STOODY COMPANY

11930 East Slauson Avenue • Whittier, California

Complete Cake Discharge

with every revolution of the Disc!

After installation of the Peterson Contour Scraper*, the customer reports 30% more capacity and lower cake moisture. He says 100% of the cake discharges every revolution—no refiltering lumpy cake which has high moisture. Note the smooth, uniform cake on the first disc which is completely discharged every revolution, by the new Scraper. With Contour Scrapers on all discs, this customer expects one filter, instead of two, to handle his tonnage.



How the Contour Scraper Works:

The Contour Scraper is a three-section scraper, as shown above. Rubber blade is held by Plates A, B, C, which hinge independently of each other. As the bag inflates, the center section, plate C, contours out while sections A and B remain in place. Blade contours to the bellow. The action remains free, no freeze from sludge becauses all parts are sealed and lubricated.

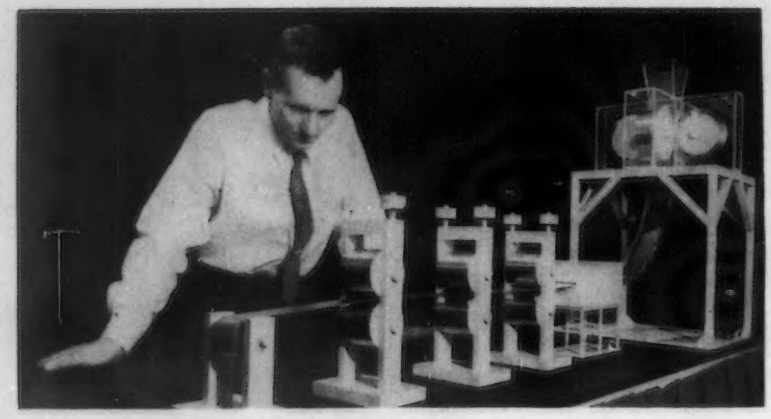
Contour Scrapers can be made to fit any type disc filter.

Write for folder CS-102-A.

*pat pend.

Look for filter parts with the Viking Mark

PETERSON FILTERS
AND ENGINEERING COMPANY
P. O. BOX 606 • SALT LAKE CITY 10, UTAH



Republic Develops 'By-pass' Steel Process

A PROCESS that takes high-grade iron concentrate and rolls it into strip steel without melting or smelting has been developed by Republic Steel Corp. (see E&MJ July 1959 p 17). While considerable research still lies ahead of commercial development, the process is considered extremely valuable to Republic. A pilot plant to produce continuous quantities will be built from the laboratory model shown above.

The new process has great potential cost savings in capital investment—since it eliminates coke ovens, blast furnaces, open hearths and blooming mills. Iron ore is reduced by direct reduction then funneled between four rolls where it is compressed into semi-steel strip. The strip passes through a furnace where it is heated to 2,200 deg F in a reducing atmosphere and is hot rolled to desired gage and full density. The finished steel has the same high quality as steels made by conventional processes, according to Peter Robertson, vice president of research and planning. After rolling, the steel is pickled, cold rolled and annealed.

Alcoa and ICI Expand

BRITAIN's Imperial Chemical Industries Ltd. and Aluminum Co. of America will organize a new aluminum fabricating concern, Imperial Aluminum Co. Ltd., in England. Imperial Chemical's holdings will be 51% and Alcoa's 49%. The purpose of the joint venture is to expand world markets for aluminum.

B. C. *(Continued)*

using aircraft and newly developed geophysical techniques. The company will also be prospecting the recently-developed asbestos area in north-central B.C., where claims were staked during the winter. Exploration work in the Yukon is also included in the company's 1959 program.

Consolidated Mining & Smelting Company of Canada Ltd. has made a $1,000 award through its suggestion plan to Ellison Stuart of Kimberley. Stuart proposed a better method to produce the copper sulphate solution which is used as a flotation reagent, and his idea was recently placed in operation. The use of filters has been eliminated and a better copper solution produced. Eighty-six other awards were made, bringing the total to $1,840.

Continental Mining Corp. Ltd. plans to re-open its Phoenix copper properties, and has purchased the Rawhide and War Eagle claims, formerly key claims in Granby Consolidated operations. Rawhide has been represented as containing a reserve of some 200,000 tons which can be mined by open-pit methods. The company is having the new claims examined. Records disclose that 943,108 tons of ore were mined in the Rawhide claim with a value at prices obtaining prior to 1916 of $7-million in copper, gold and silver.

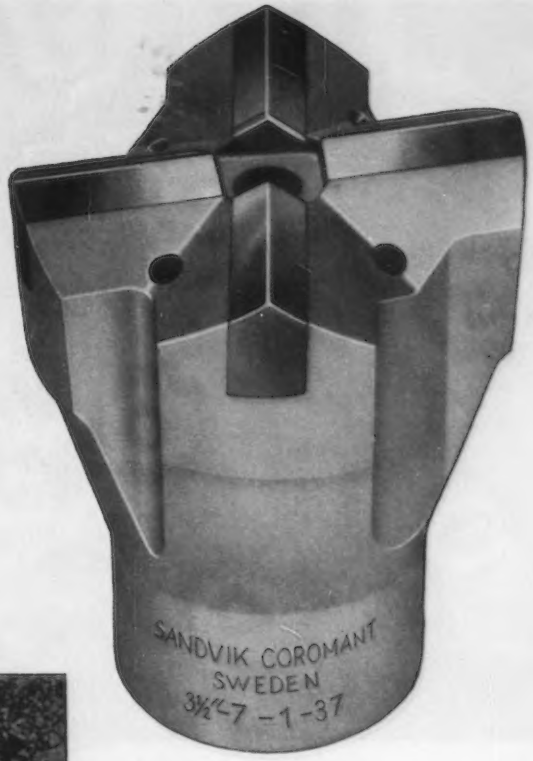
A new company, giant Nickel Mines Ltd., has been formed and has purchased the property of the liquidated Western Nickel Ltd. Western Nickel's old property near Hope will be returned to production by Giant Nickel and it is hoped that the development will reactivate and provide a new field of operation for Giant Mascot Mines Ld., almost dormant since 1956.

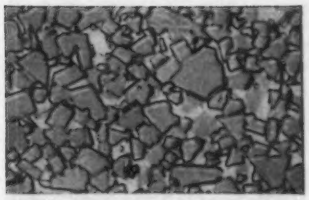
Pacific Nickel Mines Ltd. will hold 49% interest in the new company and Giant Mascot will hold 51%, which it bought from Newmont Mining Corp. and Sherritt-Gordon Mines Ltd. Giant Nickel has contracted with Sherritt-Gordon for the sale of up to 22,000 tons of nickel concentrates to the S-G smelter at Fort Saskatchewan, Alberta. Giant Nickel has 1-million tons of proved ore reserves and plans to run its 1,000-tpd mill at about 25,000 tons or ore a month.

LABRADOR

A wide-ranging exploration program in Labrador and Newfoundland is being charted by British Newfoundland Exploration Ltd. This year's exploration

Longer bit life— with *new* Sandvik Coromant Bits





Sandvik Coromant Tungsten Carbide (Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities —therefore stronger, longer-lived.

Low quality Tungsten Carbide (Microphoto) Black marks are contaminations caused by deficient production control. They weaken the carbide, reduce its working life.

NEXT time you buy bits, specify Sandvik Coromant because they give more footage per bit, lower drilling costs. Here's why:

1 Only first-quality tungsten carbide is used —as shown in the microphotos above. This means less wear, longer life and a better job.

2 The bodies are precision-made of high quality alloy steel—tough enough to take the strain throughout the extra-long bit life.

3 The bigger Sandvik Coromant bits are all of X-design, which prevents rifling. No wonder Sandvik Coromant inserts are the most widely used in the world, drilling more than one billion feet every year.

SANDVIK COROMANT bits are supplied through Atlas Copco, the world's largest manufacturer of rock drills, who also supply Sandvik Coromant integral steels — the most widely used in the world — and Sandvik Coromant extension steel equipment.

Sandvik Coromant Detachable Bits are Available in the following Thread Sizes and Bit Diameters

Available Diameters, in Inches

Type	Thread	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2¾	3	3½	4	4½	5
SHOULDER	TAPER	x	x	x	x													
	F		x	x														
	113		x															
	H			x	x	x	x	x		x								
	115			x	x													
	D						x	x	x	x	x	x	x	x				
	K													x	x	x	x	
BOTTOMING	1" Rope				*x	x	x	x		x								
	1¼" Rope						x	x	x	x		x		x				
	400						x	x		x		x						
	1½" Rope											x	x	x	x	x		
	600											x	x	x	x			
	700													x	x			
	J7.5															x	x	
	2" Rope														x	x	x	x
	1000																x	

Write or phone today for further details to either of the addresses below:

610 Industrial Avenue
Paramus, New Jersey
COlfax 1-6800

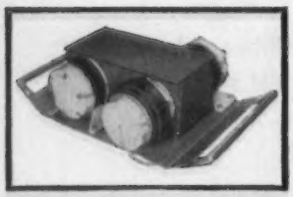
Atlas Copco

930 Brittan Avenue
San Carlos, California
LYtell 1-0375

now...put 7500Volt portable power cable to work... easily, quickly, safely!

Extend high-voltage a-c power quickly and easily as work progresses—with safe, convenient PLM Cable Couplers. Built especially for service both in open-pit and deep-mining operations, they meet the increasing need for equipment that will permit use of higher a-c voltage systems.

PLM Cable Couplers simplify joining lengths of portable cable together or to electric shovels or portable substations. Each coupler consists of connecting plug and socket, fully insulated and ruggedly protected and weatherproofed against electrical or mechanical damage. Optional locking and grounding features meet complete range of requirements. Rating, 300 amperes, 7500 volts, grounded neutral. Write today for descriptive bulletin 375. PLM Products, Inc., West 150th Street, Cleveland 11, Ohio.



3 AND 4-WAY ASSEMBLIES
Plugs or sockets are also supplied in 2, 3 or 4-way assemblies for connecting 2, 3 or 4 cables.

SAFE
no exposed connections

SAFE
electrical and key-type interlocks guard circuit

SAFE
contacts always made or broken within housing

CABLE FITTINGS · TERMINATORS · SPLICING KITS

CABLE PLM COUPLERS

Labrador *(Continued)*

bill for Brinex, the subsidiary of British Newfoundland Corp., is estimated at $240,000. Brinex is fielding 60 men and exploration work has started. Brinex, working jointly with Gunnex Ltd., a subsidiary of Gunnar Mines Ltd., is prospecting in the Nipishish and Pottles Bay areas in Labrador, seeking base metals and uranium orebodies. Intensive prospecting and geochemical work on Bonne Bay in the Bay of Islands area is also underway.

Also the company, in collaboration with Asbestos Corp., has other crews exploring the Ujutok area on the Labrador coast. The main interest is in quartz veins, sulphide occurrences, and crysotile fiber.

In collaboration with Anglo-American Corp. of South Africa, Brinex is prospecting for uranium in 80 sq miles of Labrador's Makkovik region, and for base metals on Newfoundland's Halls Bay. The company, in association with the T. H. Jones syndicate, is investigating magnetite iron occurrences in northern Labrador. Brinex states that preliminary concentration tests here have been favorable.

Brinex is continuing exploration work northeast of Bay of Islands on lead-zinc occurrences and is doing work on manganiferous beds in the Avalon peninsula of Newfoundland. It has contracted for 1,000 sq miles of airborne geophysical surveys in Labrador, especially in the vicinity of the Wison-Winokapau lakes in the central portion of the area.

ONTARIO

Pitchvein Mines has planned an exploration program for its recently acquired gold property in Melba Twp., some 12 miles north of Kirkland Lake. Work is to include dewatering of the shaft, sunk in previous operations to a depth of 225 ft, underground sampling, and exploration. Previous work carried out prior to suspension in 1939 intersected two veins on one level at the 185-ft horizon.

Recent underground developments at the copper producing property of Temagami Mining Co. at Lake Temagami has extended the high grade No. 6 copper orebody to the bottom or 825-ft level. The top of the orebody was encountered on the 525-ft level and drilling below that horizon extended length to about 200 ft and indicated upwards of 40,000 tons of high grade ore. Extension of the ore to the 825-ft horizon is expected to add considerably to this tonnage. The company is tuning up its mill, currently rated at 120 tpd. It is expected to work this up to 150 tpd shortly.

High grade ore from the new deep levels at Upper Canada Mines Ltd. in the Kirkland Lake area is beginning to be felt in production returns. The first month that showed appreciable gain in average recovery was May, when production totalled $164,670 from 16,418 tons, an average of $10.03 per ton.

Questions

We've been asked about the Yieldable Arch

"When using Yieldable Arches as we advance a drift, is it necessary to install temporary props for support?"

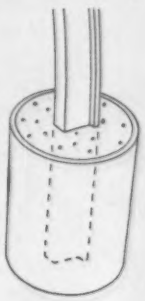
Not at all. You can usually install the Yieldable Arch right next to the breast of the drift. This brings the overburden under immediate and permanent control, without the time and expense of temporary roof support.

And we do mean *control*, for as soon as the surrounding forces bear down too hard, the Yieldable Arch will "give" a little, instead of collapsing. This allows the overburden to settle gradually until it forms a natural pressure arch around the mine opening.

In cases where the ground is heavy, or otherwise bad, forepoling or spiling will give immediate protection while the Arch is being installed.

"What kind of base or footing should be used with the Yieldable Arch?"

If the bottom of your drift is definitely firm, you can set the Arches directly on the rock itself. Otherwise you should set them on footings. Wood blocks are frequently used for this purpose; so are short pieces of steel plates, channels, I-beams or other steel "leftovers."



If an acid water condition exists in your mine, it's well to set the Arch legs in concrete. A short length of pipe will serve as a permanent form in which to pour, as shown in the sketch.

"What is the recommended placement of Yieldable Arch sets in curving drifts?"

Curves present no special problems. Place the sets radially, with the normal strut spacing on the *outside* of the curve. Struts for the inside of the curve are simply cut to suit the reduced spacing.

In the case of a pitching drift, Yieldable Arches should be placed perpendicularly to the drift, not vertically. This makes lagging easier, and also tends to distribute loads more uniformly.

SEND US YOUR QUESTIONS

Send in your questions concerning the application of the Yieldable Arch or Ring to your mine. We will study your problem and reply as promptly as possible. Write Room 1041, at the address below.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

For Years... and Years... and Years of Highly Efficient Concentration

The SuperDuty® DIAGONAL-DECK® table is noted for high grade concentrates, minimum loss to the tailings and greatly reduced volumes of middlings for re-circulation, hence more tons of new feed handled per day.

Equally notable is the table's ability to work at this same high level of efficiency for years on end . . . and with scarcely a glance from the operator. One man can supervise an entire battery of these tables . . . "as many as he can see."

With such performance, the cost of concentration is exceptionally low . . . lower than for any similar piece of equipment.

For full information about this established table, send for Bulletin 118-C.

CONCENCO® Feed Distributor

While unexcelled for feeding ore concentrating tables, the CONCENCO Feed Distributor effectively provides an accurate splitting of feed into any desired number and proportion of parts to feed circuits or machines in battery for their greater overall efficiency. It is a heavily fabricated all-steel machine with motor drive requiring 1 h.p. or less in operation.

THE DEISTER ★
CONCENTRATOR
COMPANY
903 Glasgow Ave. • Fort Wayne, Ind., U.S.A.
CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

Ontario *(Continued)*

Extensive exploration is currently under way on the Kam Kotia base metals property of Violamac Mines Ltd., some 14 miles west of Timmins. Previous work on the property outlined an estimated 825,000 tons averaging 1.95% copper and 0.2% zinc and indicated an additional 600,000 tons averaging 4% zinc and 0.5% copper. Both deposits are mineable by open pit separately. Recent drilling has indicated extension of the ore zones. The property was brought into production by Wartime Metals Corp. in 1943 and produced 189,064 tons of 2% copper. Production was terminated in January 1945.

Sherbrooke Metallurgical Co. has been formed by Matthiesen & Hegeler Zinc Co. of LaSalle, Ill., to build a zinc smelter at Port Maitland on the north shore of Lake Erie. It is proposed to produce sulphuric acid, fertilizers, and refined zinc. Roasting of zinc concentrates would provide the sulphur dioxide gas required to manufacture the acid. It is understood that a portion of the acid output would be sold to Electric Reduction Company of Canada, which has a plant nearby.

The Porcupine gold camp celebrated its 50th anniversary early in July. The camp has produced over $1.3-billion in gold since its discovery a half century ago. The three major contributors during this period are the Hollinger Consolidated Gold Mines with output of about $500-million, the McIntyre Porcupine Mines with some $252-million and Dome Mines with about $220-million. All three are still producing, and in all, 11 gold mines are in operation in the camp.

The largest government sponsored airborne magnetic survey ever carried out in Canada is now in progress over a 60,000-sq mile area in the north-western section of the province. The territory being surveyed lies east of Red Lake, west of Nakina, and stretches from the C.N. Ry. north to the 53rd parallel. In the same section of the province major exploration programs are being carried out by International Nickel Co., M. J. Boylen, Dr. N. B. Keevil, and J. E. Ayrhart. These programs include aerial and ground geophysical surveys, surface sampling, and drilling.

Underground development is in full swing at the Red Lake gold property of H. G. Young Mines. The shaft was completed to depth of 1,052 ft and crosscutting is now under way on the 500-, 650-, and 900-ft levels. Drilling is also being done on the first or 300-ft level. The main zone is located about 1,000 ft from the shaft with a subsidiary or parallel zone at approximately half this distance. The property adjoins the gold producing Campbell Red Lake Mines, which is directing the operations.

Willroy Mines has completed deepening of the main production shaft to 1,562 ft at its base metals producing property in the Manitouwadge area. Work is pro-

(Continued on p 148)

One of Mr. Janney's Macks leaving the phosphate mine with a load of ore. The haul road drops 2,000 feet in the five miles from the mine to the unloading site. The mine (operated by the Utah Construction Co.) is located near Garrison, Montana, at an elevation of 6,000 feet.

When it's a matter of profitable hauling...

The smart money rides on MACKS!

"Not only phosphate ore rides on our Macks—so do our profits," says Mr. W. P. Janney, of Garrison, Montana.

"Our Mack trucks constantly operate on excessively steep grades, during a working season limited to seven months per year because of snow. Yet they keep an on-time schedule, with little down time and low operating costs. That's why we're putting in an order for more Macks. When it comes to profitable hauling, we put our money on Macks!"

There's a good reason why hauling costs hit rock bottom when Mack trucks handle the job. Macks are quality-built from front bumper to rear axle; rugged major components—front and rear axles, frames, brakes, transmissions and engines—are built to the highest standards in the industry, in Mack's own factories . . . your assurance of trouble-free, economical operation, year after year.

Mack specializes in solving difficult hauling problems. Get in touch with your Mack branch or distributor, and ask to have a specialist in profitable hauling call on you—soon. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

MACK
FIRST NAME FOR
TRUCKS

American Gold Losses Dominate in 1959—Pick

The following article, by one of the world's leading observers of gold price in both official and unofficial markets, puts forth another side to the current discussion of the yellow metal in today's world economy.

For further points in the discussion, see E&MJ's *February 1959 issue, p 113, and the editorial in June 1959, p 95.*

FRANZ PICK

THE GOLD STOCK backing the U.S. paper dollar shrank, with very little interruption from the end of 1957 through the first months of 1959. Withdrawals, made by not more than a dozen foreign governments, reduced U.S. gold holdings from $22.857-billion to $20.582-billion within one calendar year, and to $20.189-billion at the end of May 1959. The 11.5% reduction of the U.S. gold reserve in 17 months was the result of a marked strengthening of major European currencies.

Washington stated that the increase of gold holdings, backing Western Europe's hardening currencies, could only improve convertibility and thus increase world trade. Washington's view was not shared by many of the world's leading currency managers who thought that the constant debasement of the Dollar's purchasing power could not be stopped and that the monetary administration in Washington would have to face a major currency reform in the future.

The reform, they thought, would have to be based on an increase in the gold price. And in order not to be caught by a possible American gold embargo, many of the Central Bank governors preferred to reduce Dollar assets in the U.S. by increasing gold stocks.

The American gold price of $35.00 per oz established in 1934 has since become debased. The present purchasing power of the Dollar, if compared to its buying value of 1940, is about 48c.

Dominating the U.S. gold stock position is a considerable mortgage. At the end of May 1959, the U.S. owned $20.189-billion in gold. Foreign governments at the same time had a total of at least $11-billion of Dollar assets in the U.S. Foreign Dollar assets are convertible at any time into gold. Washington has to sell the metal at $35.0875 per oz to every government asking for it and paying with U.S. Dollars. The real gold stock, owned free and clear by the U.S. is not more than $9.2-billion. The U.S. gold stock serves as backing for over $30-billion of banknotes, $240-billion of total bank deposits and also about $285-billion of Federal debt. Any future major withdrawals of the metal by foreign governments could create serious problems for the maintenance of the U.S. gold price. The rise in Soviet gold production will possibly have some bearing on U.S. gold policy.

Russia continued to sell gold in Western trading centers in 1958 and early 1959. The amount of her shipments, totaling about $200-million to $220-million in 1958, was smaller than the $300-million which Moscow exported in 1957. At the same time, Soviet gold production was believed to have increased from nearly $600-million in 1957 to about $665-million in 1958.

As a result, Russian output of gold exceeded South Africa's 1958 gold production of $618-million for the first time in history. The Soviet output apparently having a high priority in Moscow's over-all planning, rose to 63% of the total of the Free World's gold production. It enabled the Russian currency administration to increase its gold stock to an estimated $8.3-billion at the end of 1958. This was the second largest quantity in the world—free of mortgage—owned by a single government. It came close to America's net gold stock of $9.2-billion.

The rise of Soviet gold production and of their monetary holdings of the metal also lent credibility to rumors of Moscow's planned creation of a "Non-Resident Gold Ruble." If and when legalized, the unit would permit any "capitalist" to convert hard currency into freely exportable gold in the USSR.

Gold production rose to its highest level in history in 1958 (see E&MJ, August, 1958). But the output still was not sufficient to provide enough gold for all the currencies that needed it. The amount of mined gold, including capitalistic and collectivistic production, has been estimated at about $1.774-billion, compared to its pre-war high of $1.4-billion in 1941 (see table, "International Gold Production").

Soviet and Satellite gold production has been estimated as follows for 1957:

Soviet Union (19-million oz)	665
North Korea (950,000 oz)	35
China	12
Rumania	9
All other Satellite countries	4
Soviet Total	725

The rise of about 26%, compared to an increase of 29% of the world's population in 17 years, indicates an insufficiency of gold production. The constant increase of paper money circulation and bank deposits illustrates the perpetual need for increasing gold output.

Official gold holdings of international agencies and monetary administrations, the Soviet orbit and unpublished French estimates totaled $89.33-billion at the official gold price of $35.00 per oz. Principal distribution was as follows:

	In millions of U.S. Dollars
United States	20,582
United Kingdom	2,850
West Germany	2,639
Switzerland	1,925
Canada	1,078
Belgium	1,270
Netherlands	1,050
International agencies: International Monetary Fund, European Payments Union, Bank for International Settlements	1,796
Estimated unpublished French holdings	600
Estimated Soviet gold stock	8,300
Estimated Satellite gold stocks	700
All others	6,675
Total	49,465

Added to the official holdings are private gold hoards which gained in volume in 1958. Hoarding was favored in Germany, where the government removed all restrictions on ownership of coins and bars. Since the second half of 1957, major gold purchases were made by large American estates, as well as by wealthy individuals who started to gamble on a Dollar devaluation.

Private American purchases in London and Zurich gave to the respective

International Gold Production

(In millions of U.S. Dollars, based on $35.00 per oz)

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958 (est)
Union of South Africa	409.7	408.2	403.1	413.7	417.9	462.4	510.7	556.0	596.1	618.0
Canada	144.2	155.4	153.7	156.5	142.4	152.8	159.1	153.9	154.7	158.8
U.S.A.	67.3	80.1	66.3	67.4	69.0	65.1	65.7	64.3	63.6	63.0
All others except USSR and Satellites	218.8	220.8	216.9	230.4	235.2	233.2	223.5	213.8	211.1	209.2
Total	840.0	864.5	840.0	868.0	864.5	913.5	959.0	988.0	1,025.5	1,049.0

Changes in Private Gold Hoards

(In millions of Dollars at $35.00 per oz)

End of October	1952	1953	1954	1955	1956	1957	1958
France	$ 4,000	$ 4,000	$ 3,800	$ 3,700	$ 3,800	$ 3,900	$ 3,900
All other Europe	2,100	2,200	2,000	1,600	1,700	1,800	1,900
Asia	2,000	2,400	2,500	2,600	2,700	2,900	2,900
Africa	1,900	1,800	1,400	1,500	1,400	1,400	1,500
Western Hemisphere	1,200	1,400	1,400	1,300	1,500	1,600	1,700
Miscellaneous	700	700	600	700	800	800	900
Total	$11,900	$12,500	$11,700	$11,400	$11,900	$12,400	$12,800

Herringbone's two pairs of Lang lay strands and one pair of regular lay strands provide the ideal combination of maximum flexibility with good stability.

Finer wires inside contribute to Herringbone's excellent drum-winding characteristics.

Heavier outside wires in each strand have greater resistance to abrasion.

"...and it has a much longer life"

GASKILL CONSTRUCTION COMPANY

The above quote is one of the things that Gaskill Construction Company says about the new Roebling Herringbone* Wire Rope. There are further quotes: ". . . We, after giving your Herringbone cable a great deal of use, find that it is far superior to any other cable and it is much more economical."

These are *user* statements about the newest design development in wire rope in many years. Herringbone is the regular lay and Lang lay wire rope. It is two-ropes-in-one rope, with the best features of each in combination. It has been used, with the same success quoted here, on a wide variety of machines as well as on tough hoisting jobs. Its potential is virtually unlimited wherever all-steel ropes are specified and on most installations where fiber core ropes are standard.

Your Roebling Distributor has full details on Herringbone, or contact Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

*Reg. App. for

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

ROEBLING
HERRINGBONE
WIRE ROPE

Pick *(Continued)*

Central Banks the very Dollars that they could reconvert into gold in the U.S. Total gold hoards rose in the year ending Oct. 31, 1958 and gained 3¼% over the corresponding 1957 amounts of privately held stocks. The total hoard of $12.8-billion corresponds to 62% of the official U.S. gold stock. The sum shrank, if measured by the loss of purchasing power of the Dollar, by at least $256-million in buying value.

But the hoarders disregarded their loss, as well as the non-interest bearing quality of this shrinking capital. They waited patiently for an increase of the official gold price in the U.S., and some began to buy options on gold futures in London for one year's delivery.

Principal variations of private gold hoardings since 1952 are shown in the table.

Legal, illegal or tolerated, private gold trading continued unabated. During 1958 and the first months of 1959, more freedom of trade was given to the residents of many countries. Canada, for the first time in history, started to list one-kilogram bars officially on the Toronto Stock Exchange. In early 1959, a private bank issued gold certificates which had transferable ownership to London. Most of the countries of the European Common Market either removed or substantially eased restriction on gold trade.

A world-wide survey of legality of gold ownership, as of March 31, 1959 establishes the following facts.

At the beginning of 1959, sales of coins and bar gold in Paris had to be considered as the largest in all existing markets of the metal. Daily transactional volume in the French capital fluctuated between $1-million and $2.5-million. Next in rank was the official London gold market. Zurich, Milan, Amsterdam, Frankfurt, Athens and Istanbul followed in size of volume. On the Asiatic Continent, Bombay led in transactions, followed by Beirut, Kuwait, Hong Kong, Macao, Bangkok, Singapore, Djakarta, Rangoon, Tokyo, Manila, Taipei and Seoul. Alexandria and Cairo in Africa ranked high with Djibouti and Casablanca next in importance.

Tangier, once one of the world's foremost trading centers of gold, regained part of its past importance. A Royal decree, issued early in 1957, recreated part of its former freedom of foreign exchange and gold dealings. But the old flow of considerable gold business has not returned to the city.

In the Western Hemisphere, Mexico City led in volume. Toronto, New York, Montevideo, Panama City, Santiago, Buenos Aires and Rio followed in that order.

Private gold transactions in 1958 rose about 33% above the previous year's turnovers. Amounting to nearly double the quantity of the Free World's production of the metal, the transactions were only about 8% of the total import volume of the non-Soviet world.

After the Sterling devaluation of 1949, gold prices began to decline internationally and came near the $35.00 level in May 1950. The Korean War reversed the tendency in all principal gold markets and increased prices between 20% and 30% within a few months. Beginning in July 1951, gold prices resumed their down-trend.

The price picture in London's market changed abruptly in February 1958 when gold began to sell as high as $35.08, instead of its usual price of $35.00 or less. During March 1958 the metal sold at up to $35.145.

Washington sells gold to any government that can pay with U.S. Dollars at a rate of $35.0875 with shipping and insurance to Europe amounting to about $0.12 per oz. Should the gold price in London have risen to $35.21, it would have been cheaper to buy gold in the U.S. than in London, and a run on the American gold reserves could have started. Washington had to sell large amounts of the metal in order to prevent such an event. Nevertheless, London remained the cheapest supply center of gold in the world and America's official gold stock seemed more protected.

But in April, the price in London rose to $35.1475, its highest since 1954, and a new drain on U.S. gold began. At the end of May, the gold price in London still listed at the relatively high level of $35.12.

Photo - Courtesy, United States Steel Corporation.

Tough cars for a big job . . .

In 65 years or so the first dipper hole at Mesabi has grown to the tremendous open pit pictured here in part. Differential Air Dump Cars first put in appearance at Mesabi in 1925. Veterans of many years and thousands of tons, these cars have carried their loads uncomplainingly. Steady reorders have a pleasant way of nodding approval. We would be glad to tell you more about Differentials — how they're made and why you'll like them.

PIONEERS IN HAULAGE EQUIPMENT SINCE 1915

D
DIFFERENTIAL
STEEL CAR COMPANY
FINDLAY, OHIO

PICKLED in a 4% brine solution!

CHOKED
in a tornado of abrasive dust!

FROZEN
for weeks at 75° C below zero!

BURIED ALIVE
in thick, sluggish mud!

nothing . . . but nothing stops Super-Seal open-type motors

Thanks to exclusive Poxeal and Silco-Flex insulations, Super-Seal motors have shown endurances that even enclosed motors couldn't match. Results and reasons available from your A-C representative or distributor. Or write General Products Division, Milwaukee 1, Wisconsin

ALLIS-CHALMERS A-C A-1151

Poxeal, Silco-Flex and Super-Seal are Allis-Chalmers trademarks.

Ontario *(Continued)*

gressing in the development of the new No. 6 copper zone, which is scheduled to provide some 300 tpd, or approximately one-third of the mill tonnage, by the fall of this year.

Iron ore shipments from Steep Rock Iron Mines near Atikokan are running well ahead of last year. Estimated shipments, to the end of June 1959, stand at approximately 900,000 tons. For the same period of 1958 the total was 118,408 tons and for the full year 1958—1,156,358 tons. Peak year was 1956 when 3,317,073 tons were shipped.

North American Rare Metals has set tentative production targets for the spring of 1963 at about 10,000 tons of iron concentrate per day from its property in the Temagami area (see E&MJ, May 1959, p 160). Present thinking places output at about 1.4-million tons of iron pellets annually. The shaft has been collared and erection of the headframe is in progress. The shaft is planned to go to a depth of 1,350 ft initially, after which bulk sampling will be done on the 1,200-ft horizon.

Work has been resumed at the gold property of Lake-Osu Mines in the O'Sullivan Lake area. The program includes geophysical survey and diamond drilling. In previous operations a shaft was sunk to below 300 ft and two levels established. On the 2nd, or 300-ft level, an oreshoot was opened along a length of 262 ft. Grade averages 0.67 oz gold across 5.0 ft.

CHECK

Connellsville

for Engineered & Co-ordinated

SHAFT PRODUCTION EQUIPMENT

including: Sheaves • Skips & Loaders • Self-Dumping Cages, Platform Cages, Cagers

SHAFT HAULAGE EQUIPMENT

including: Hoists (friction & winder types) • HoistPak* (Converts manual to automatic) • Man & Material Cages • Automatic Elevators

CAR HANDLING EQUIPMENT

including: Car Spotters • Car Hauls • Rotary Car Dumpers

COKE OVEN EQUIPMENT

including: Coke Machines • Pushers • Levelers • Coal Larries

ENGINEERING SERVICES

including: Co-ordinated systems for Shaft Production Haulage—Car & Materials Handling

*TM

Raising Production SINCE 1901 Connellsville MANUFACTURING

CONNELLSVILLE, PENNSYLVANIA

QUEBEC

Norlartic Mines started ore shipments to the neighboring Malartic Gold Fields mill in the Malartic area, early in June. The current rate is scheduled at 200 tpd with expectations of increase to 400 tpd by the end of the year. Development results have been much better than had been expected originally. To early July, work on the bottom, or 1,000-ft level, had opened a continuous length of 135 ft grading 0.33-oz gold, with ore broadening out to better than drift width for the last 70 ft.

Newmont Mining Corp. has indicated encouraging results in diamond drilling on an optioned property in Galinee Twp., Mattagami area. Initial drilling along north-west trending rock structures, indicated by magnetometer survey, returned zinc values and minor copper and silver values. Drilling is being continued. The property adjoins the main Orchan Mines' group on the south.

Current diamond drilling by New Hosco Mines on its Mattagami area property is adding to estimated tonnage of the original deposit. Two drills are in operation on the group. Latest ore estimates, made late in June, gave 1.6-million tons grading 2.57% copper. This included 1.2-million tons of 3% copper. Separate from but parallel to the main zone is a zinc structure estimated to contain 780,000 tons averaging 8.15% zinc.

Akasaba Gold Mines is expected to start ore shipments to the nearby Vecon Mines' mill in the Bourlamaque area in September. In previous operations a shaft was sunk to below 300 ft with lateral work carried out on two levels. At the time of suspension of operations, there was an estimated 140,000 tons of ore developed above the 300-ft level. Grade was placed at about 0.27-oz gold per ton with a small copper content. Underground workings have been dewatered and diamond drilling started. A new headframe is being constructed as well as a 300-ton ore bin. Shipments are expected to start off at about 250 tpd.

The Noranda-Rouyn area, a pioneer mining camp, is experiencing a new wave of intensive exploration. The promising copper-zinc discoveries on the Consolidated Vauze Mines' property provided the spark and many companies have moved in for a test of long dormant ground. Diamond drilling programs are planned or in progress by New West Amulet Mines, Wiltsey-Coghlan Mines, New Rouyn Merger, Lake Dufault, Quemont Mining Corp., and the Little Long Lac organization.

BOTH REDUCERS HAVE THE SAME CAPACITY!

This dramatic saving in weight and space is possible only because the reducer on the left has Philadelphia Precision Ground Gearing . . . a new development, so significant you can solve drive problems you could never solve before . . . because you get engineering advantages that have never been available before.

For the first time, standard commercial speed reducers are available with gearing of master gear quality. Extreme accuracy of profiles, profile spacing and surface finish reduce dynamic load factors. Harder gear materials can be used. Result: increased load carrying capacity without sacrificing performance characteristics.

Gear noise is reduced to the point where it is no longer a controlling factor in applications where low sound levels are important.

Backlash is reduced in reversing drives . . . and it is uniform where precision of movement is important.

Vibration is virtually eliminated because tooth to tooth errors, accumulated pitch errors and composite errors are reduced . . . smoother contact results.

Longer gear life. Improved accuracy and better surface finish eliminates "running-in" periods and the resulting wear on gearing.

If you have a new product on the boards . . . design changes coming up . . . or new drive requirements of any kind, Philadelphia Precision Gear Drives may give you the competitive edge you've been looking for. Write for full data on precision ground gearing in spiral bevel, parallel shaft and In-Line reducers as well as gearmotors and Motoreducers. If you have a special drive problem, the full facilities of our engineering staff are available to help you find the solution.

PHILADELPHIA GEAR CORPORATION
Erie Avenue and G Street • Philadelphia 34, Penna.

philadelphia gear drives

Offices in all Principal Cities • Virginia Gear & Machine Corp., Lynchburg, Va.
INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

SASKATCHEWAN

The old Beta Gamma uranium property will be reopened as a source of high-grade ore for the Lorado Uranium Mines custom mill in the Beaverlodge area of northern Saskatchewan. Lavant Iron Mines (now Lavant Mines) has acquired the mine and states it will truck 30 tpd 11 miles to the mill. Indicated ore at the property totals 6,000 tons grading from 0.5% to 0.6% uranium oxide, or 10 to 12 lb per ton. Value is estimated at $359,100 from present workings which include an adit and a 150-ft shaft.

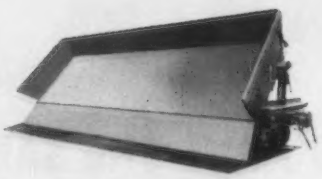
Gunnar Mines, in the Beaverlodge area, is continuing production at a maximum rate, reports president G. A. LaBine. Up to last February, operations had been maintained at maximum capacity to secure as much benefit as possible before its tax-free period ended. Now, although production has been maintained, deliveries of uranium precipitate to Eldorado Mining and Refining Ltd. have been reduced under regulations between the government-owned company and the U.S. AEC, as regards quota shipments to be made during each commission year (July 1-June 30). Current overproduction is about 25,000 lb a month.

MAGOR AIR DUMP CARS

FOR THE MINING INDUSTRY

FEWER TRIPS

Safe side dumping eliminates expensive labor and crane equipment. Completely smooth interiors permit full dumping—no "dead load" returns!

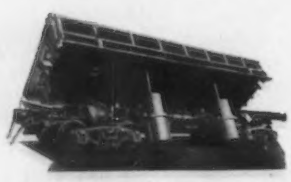


LOWER HEIGHT, OPEN BODY

Lower height, and open body means faster loading. Quick, smooth dumping action means faster unloading—saves time and labor costs.

DESIGNED FOR THE JOB

Magor Air Dump Cars are designed for the job—built to last! Actual performance records prove cost of replacement parts furnished by Magor equals less than 1/10 of 1% of the purchase price per car, per year!



Write today for details of America's leading Automatic Air Dump Car!

MAGOR CAR CORPORATION

50 Church Street
New York 7, N.Y.

IN LATIN AMERICA

ARGENTINA

U.S. steel-making firms proposed a $150-million development plan for Argentina's budding steel industry. The announcement was made by Dr. Elpidio Lasarte, representative of the Argentine Industrial Bank, speaking for a group of U.S. industrialists.

The group has already set up a company under the name of Cruz del Sur Steel Mining Co. (Compañía Minera de Aceros Cruz del Sur) to study the Sierra Grande iron ore deposits in Patagonia (Province of Rio Negro) — reported to hold reserves of 100-million tons—and to consider a suitable location for a future steel mill, the building of a railroad, and of seaport facilities for the loading and transportation of products. The U.S. proposal was made under an international tender call; the group will compete for awards on Sept. 30 with — amongst others — Friedrich Krupp of Essen, Germany, which also expressed interest in the project.

BRAZIL

A pyrochlore deposit has been located at Barreiro, 8 km south of Araxa, in the State of Minas Gerais. The approximate location has been given as latitude 19° 38′ South and longitude 46° 59′ West. Araxa is 380 km west of Belo Horizonte and accessible by commercial airlines, highways and the Rede Mineira railway.

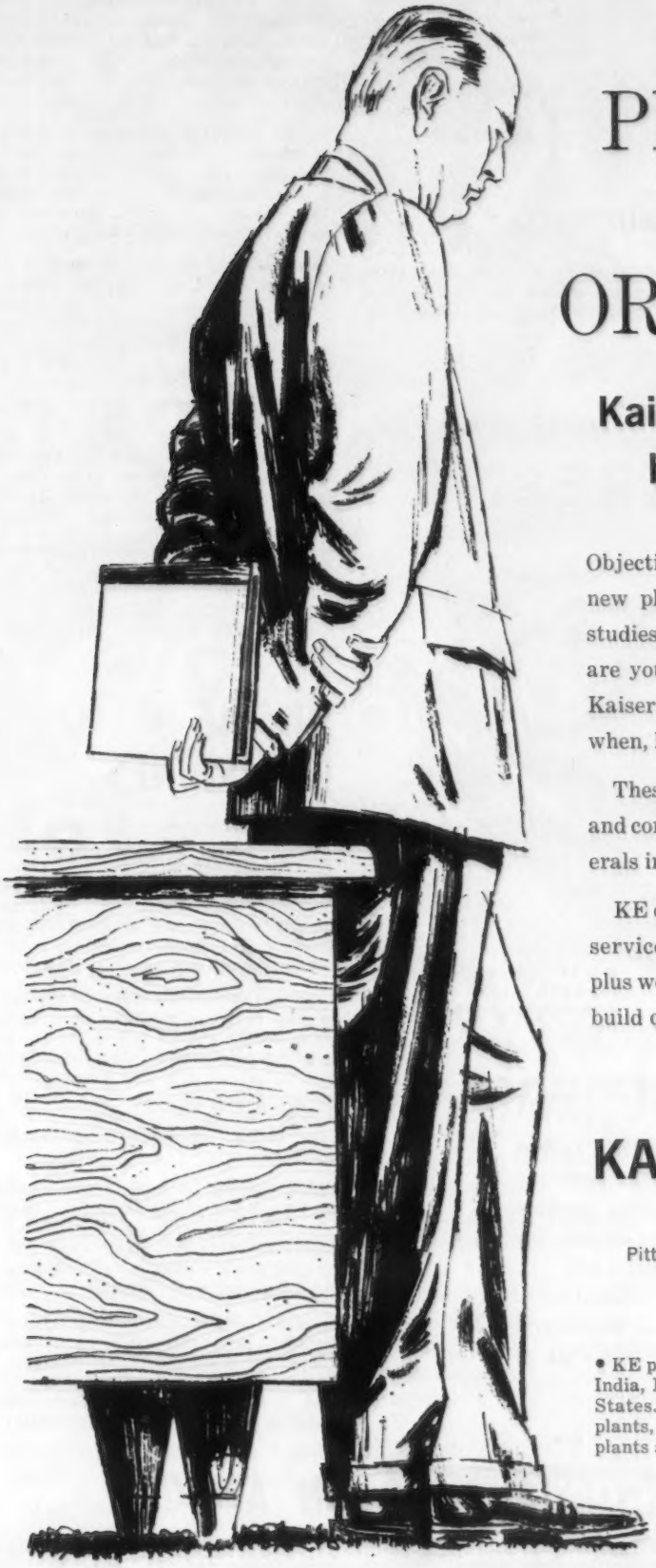
The pyrochlore deposit at Araxa was discovered by Dr. Djalma and is estimated to contain 185.7-million metric tons of ore with pyrochlore content of 5%. Assuming pyrochlore is 50% Cb_2O_5, 4.6-million tons of Cb_2O_5 are available. Also, estimates of ThO_2 and U_3O_8 content are 130,000 tons and 84,500 tons respectively.

Adequate power is now available for moderate-size mining activity and more hydroelectric capacity is being built to serve this region. No mining of pyrochlore has begun nor have any properties been developed at this time.

CHILE

The Callejas Brothers have purchased several copper mines in the old camp of Cerro Blanco located near and to the southeast of the town of Copiapó. Some of the mines were high grade producers in the old days such as the Coquimbana, which is 1300 ft deep. The same firm is also building a new flotation mill at the Quebradita copper camp near the town of Freirina, Atacama province.

Andacollo, the famous gold camp known to the Indians long before the coming



PROCEED, DEFER OR MODIFY?

Kaiser Engineers can help you decide

Objective analysis is vital to sound decision on new plant or expansion projects. Feasibility studies, economic analyses and site evaluations are yours by an outside, impartial firm when Kaiser Engineers is selected to help you decide when, how and where to proceed.

These services are in addition to the design and construction of major facilities for the Minerals industry.

KE offers complete, one-company, integrated service from concept through construction—plus world-wide experience and the ingenuity to build quickly, within budget.

KAISER ENGINEERS

Division of Henry J. Kaiser Company
Oakland 12, California
Pittsburgh, Washington, D. C., Chicago, New York

• KE projects include work in Australia, Brazil, Ghana, India, New Zealand, as well as Canada and the United States. Assignments include iron ore concentrating plants, cement plants, bauxite and alumina processing plants and diatomaceous earth facilities.

5458-M

Chile *(Continued)*

of the Spaniards to Chile under Almagro and Valdivia has changed from a gold to a copper camp. The camp is currently producing more than 700 tons of copper concentrate per month from numerous small mines and flotation mills which still use Chilean mills built in the country. A large copper mineralized bed or "manto" has been discovered.

MEXICO

The Mexican government announced that it would build a zinc smelting plant that could handle 70,000 tons of Mexico's 130,000 ton annual zinc production. The difference will be taken up by U.S. refineries.

The new plant, the government reported, will have a majority of Mexican products such as sulphuric acid.

IN AUSTRALIA

Australia's output of tungsten in 1959 may reach a record low because the biggest producer, King Island Scheelite, is not resuming production in 1959. Although the throughput at Storeys Creek, Tasmania, has been doubled, it will still not be adequate to balance the loss of the main producer. Only two mines in Tasmania will produce tungsten.

Mt. Isa Mines Ltd. will export $6-million of copper concentrates to Japan during the second part of 1959 in addition to a previous order of 18,000 tons. Japan has indicated that it is interested in further supplies if available.

Australia's big zinc-lead producer, Consolidated Zinc Corp. Ltd., will continue reduced production, but will develop its ore reserves. The company's drilling and prospecting operations for bauxite in the northern part of Australia have confirmed the existence of huge deposits of commercial value and further work is proceeding.

Mine production of zinc in Australia is continuing at reduced levels with a current annual rate of about 220,000 tons as against 260,000 tons last year.

Ilmenite producers in Western Australia are working at a small part of plant capacity. More export enquiries have been noted recently but prices are so low that economic production is often impossible to attain.

IN THE PHILIPPINES

Benguet Consolidated (see E&MJ, May 1959, p. 165) reports that its gold ore reserves are extremely good. The company had a record gold pour in April. Milling rate is about 3,330 tpd, the highest average ever recorded on the property. The company also has a new copper deposit now under development.

Lepanto Consolidated milled 38,000 tons of ore in May, estimated to contain 2,606,000 lb copper and 3,930 oz of gold. Average copper content of ore was 3.58% and average gold content 0.134 oz per ton. Copper recovery averaged 95.6%. The company declared a 10% cash dividend on its shares, the second for 1959.

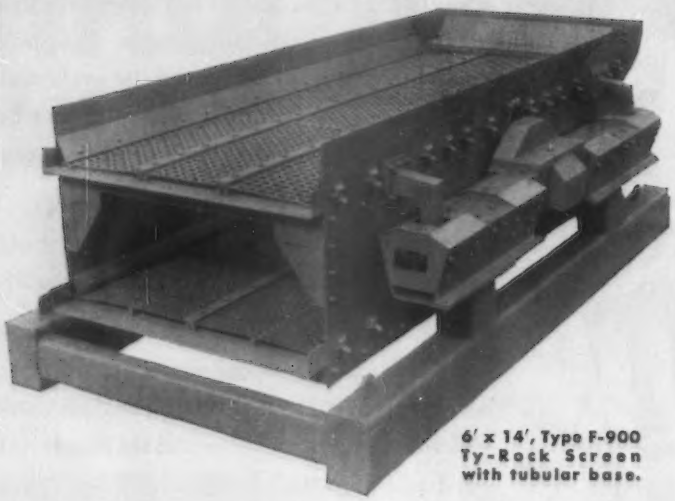
Philex Mining Corp. in Baguio milled 42,000 tons of ore in May. Total metal content of concentrates produced is estimated at 482,000 lb copper and 1,238 oz gold, with a total value of $223,00. All concentrates are shipped to Japan.

Surigao Consolidated milled 6,800 tons in May, recovering 1,582 oz of gold and 45,000 lb of lead. Value of production was $124,000. Suricon is the only lead producer in the Philippines. The metal is recovered as a by-product.

IN AFRICA

Cadmium output in the Belgian Congo reached a record of 249 metric tons

TY-ROCK SCREENS



6' x 14', Type F-900 Ty-Rock Screen with tubular base.

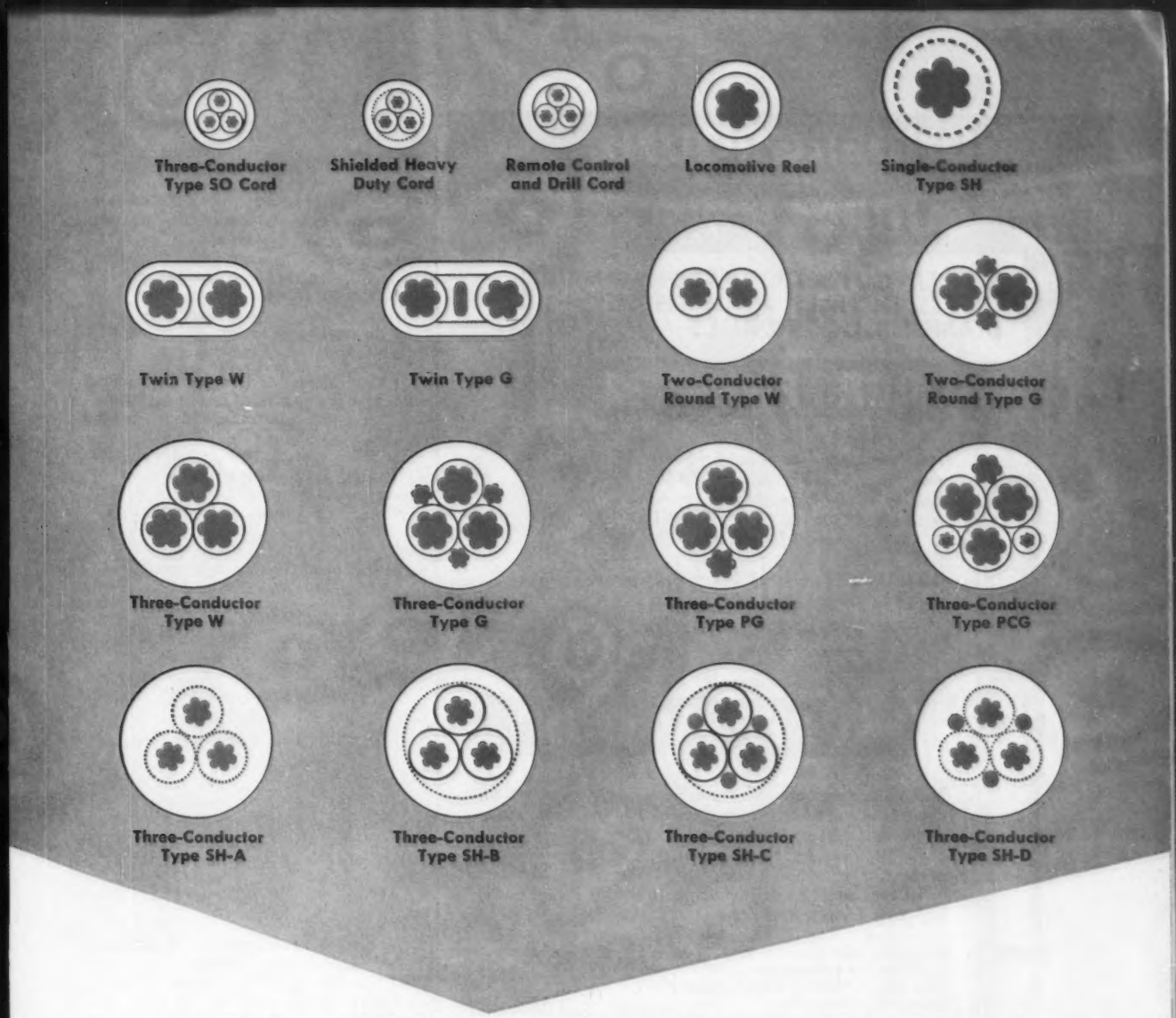
For TOP Performance

The balanced circle-throw action of the Ty-Rock plus the full-floating action on large shear type resilient rubbers enables this screen to separate material with unequalled speed and effectiveness.

The Ty-Rock wastes no power in useless, harmful racking of buildings or supporting members. It delivers all of the intense power to the job of stratifying and separating the sizes.

Telephone HE 1-5400 • *Teletype* CV 586

THE W. S. TYLER COMPANY
CLEVELAND 14, OHIO
Manufacturers of Woven Wire Screens and Screening Machinery



These OKOCORD cords and cables make tough mining jobs easier

Here are 17 of the basic Okocord constructions Okonite has developed for mining applications . . . for shovels, locomotives, shuttle cars, continuous miners and other equipment.

These tough, mold-cured flexible cords and portable cables are manufactured under the industry's strictest quality control program. Their rugged reinforced Okoprene jacket has superior flame resistance . . . plus the extra durability and flexibility that result from curing in a continuous metal mold. Insulation is tough, resilient and heat-resisting. Okocord conductors flex easily because they are formed with many fine gauge wires, twisted together with a short lay. And all Okocord cords and cables are color coded for easy phase identification.

If there isn't a standard Okocord cord or cable to meet your need, Okonite will design one . . . for *any* operation.

For the full story on Okocord cords and cables write for free BulletinEM-1108, The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

where there's electrical power . . . there's **OKONITE CABLE**

7123

UNDERGROUND OR ON THE SURFACE

YOU'LL CUT EXPLORATORY COSTS IN HALF WITH THESE DIAMOND CORE DRILLS

SUPER PIONEER

Here's a rugged compact light-weight drill you can take anywhere. The Super Pioneer eliminates guesswork by giving a true core sample to depths of 100' or more. Designed for one-man operation, drills at any angle in all formations. Gasoline-powered drill and pump weigh just 35 lbs. each.

Basic kit includes drill, pump, and accessories. Rods and bits additional.

$885.00 FOB Spokane

SUPER SCOUT

This all-new air-powered one-man drill sets up and tears down in minutes, eliminating lengthy traffic tie-ups. Hand operated hydraulic feed supplies drilling pressure up to 1500 lbs. Anchor column provides drill support at any angle with or without back wall. Drills in any direction or at any angle to depths up to 100' with exceptionally high core recovery. Weighs just 85 lbs.!

Complete unit includes drill, hydraulic feed, anchor column, hoses, 50' of rods, core barrel, starting barrel, collar pipe, tools, and storage box.

$1175.00 FOB Spokane Diamond bits additional

DIAMOND DRILL CONTRACTING CO.
S. 18 STONE ST. SPOKANE, WASH.

Eastern and Southwestern Distributor, SPRAGUE & HENWOOD, Inc., Scranton, Pa., Grand Junction, Colo. • Western Canada Distributor, AIR POWER Ltd., Vancouver, B. C. Export Representative, SPRAGUE & HENWOOD International, 11 W. 42nd St., New York, N. Y.

WANTED

Rare Earth Properties

CONTAINING Yttrium group or "heavy" rare earth elements: Xenotime, Gadolinite, Euxenite, Samarskite, or similar types of ores.

*Reg. U.S. Pat. Off.

Tell us what you have. Write:
RARE EARTHS AND THORIUM DIVISION
MICHIGAN CHEMICAL CORPORATION
657 North Benkson St., Saint Louis, Michigan

Africa *(Continued)*

during the first half of 1958; 144 tons were produced during the same period of 1957.

The Belgian Minister of the Colonies announced recently that a large bauxite deposit, reported to analyze between 40% and 50% alumina, has been discovered near the proposed site of the INGA hydroelectric project. It is also reported that the government will build the hydroelectric project on the lower Congo River, near Matadi.

A new South African chrome mine officially opened on June 6, is owned by Rustenburg Chrome Mines (Pty.) Ltd., and is sited at Rustenburg (Northern Transvaal) adjoining Rustenburg Platinum. Production is exclusively for the German chemical concern of Bayer.

Bayer, through its Union representatives, Taeuber and Corssen, has developed the mine and established an ore dressing plant at the shaft head at a cost of £250,000 ($700,000).

The first of the boreholes being drilled on the Orange Free State farm Video has reached a depth of 1,450 ft. Work on a second borehole has been started. The work is being carried out by the General Mining group.

Gold output by the South African mines reached another all-time peak in May and was running at a rate of £250,-million ($700-million) annually compared with £200-million ($636-million) a year ago. The May output figure was 1,672,361 oz—an increase over the April figure of 18,655 oz. It was 13% higher than last year and was valued at £20,-827,863 ($58,318,000).

The dying gold-mines of the Witwatersrand will be closed gradually and without the serious results feared in some quarters, said minister of mines Senator Jan de Klerk, in the senate last week. The problem of the marginal mines had existed for many years and would recur continuously as long as South Africa had a mining industry.

Of the 31 large gold-mines in the Rand area, 14 were so-called marginal mines. But during 1958 these 14 mines had still been responsible for 33% of the gold yield of the area.

Development values obtained at Merriespruit, an Anglo-Vaal mine in the Orange Free State, from the twin haulages driven from the adjoining Virginia mine, reportedly have been most disappointing. Throughout the length of the haulages, which now have been advanced 6,763 ft and 6,488 ft respectively, inside Merriespruit, contact has been maintained with the Basal Reef by means of underground boreholes and a limited amount of development. The last 3,600 ft of work has failed to disclose ore.

The International Bank for Reconstruction and Development (World Bank) has made a loan equivalent to $35-million to help develop high grade manganese deposits in the Gabon Republic.

FOR CONTINUOUS SERVICE IN HEAVY DIGGING

MARION 181-M

The new levels of output and efficiency made possible on operations that can use large haulage units make the Marion 181-M a logical machine for expanded pit mining operations.

Here's a husky 8-yard machine with the traditional strength, power and endurance of Marion mining shovels - - plus small machine cycle time for an extra payoff every day.

With low-maintenance Ward-Leonard controls, power is applied smoothy and quickly, yet held within controlled limits that safeguard the machine against undue shocks or strains.

The chain propel simplifies crawler design and provides increased protection for the final propel mechanism, especially on shovels where the drive chain is enclosed and dips in oil.

A disc-type air clutch permits the operator to engage the travel mechanism without stopping the machinery, permitting faster move-ups.

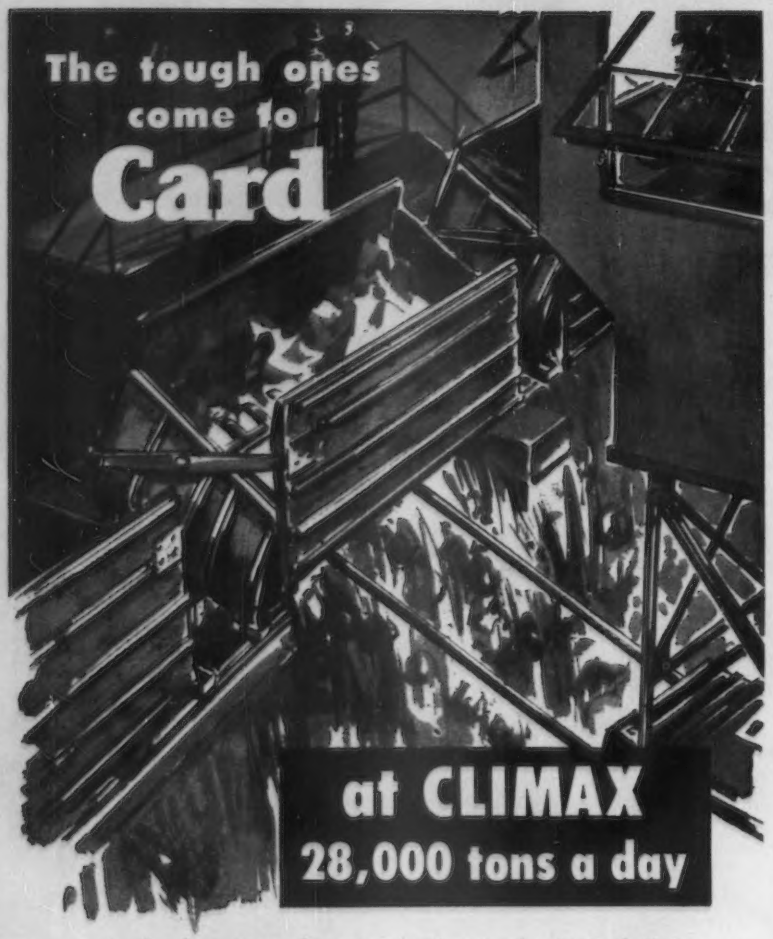
If you haven't seen Bulletin 439 on this 8-yard Marion, write for your copy today.

CONSULT MARION MINING SPECIALISTS

for lowest costs on your property!

MARION POWER SHOVEL COMPANY • Marion, Ohio, U.S.A.

A Division of Universal Marion Corporation



In the largest underground mine in the United States, over 70% of the daily production of 28,000 tons of molybdenum ores—more than half of all the moly this side of the iron curtain—is hauled in Card Granby type cars built to Climax specifications.

These are the largest and heaviest cars of this type we have built . . . designed to withstand unusually rugged loading conditions plus the wear and tear inflicted by a cleanout machine (also a Card product).

CARD car engineering results in large savings to many of the major ore producers of the world with cars built to special order at little more than the cost of standard stock models. CARD engineers are happy to consult on any haulage problem. No obligation.

C.S.Card Iron Works Co.
2501 WEST 16th AVE.,
DENVER, COLORADO

Africa *(Continued)*

The loan was made to the Compagnie Miniere de l'Ogooue (Comilog), a company incorporated in the republic which formerly was part of the Federation of French Equatorial Africa and since last fall has been an autonomous state within the French Community.

The World Bank said Comilog's ore deposits covered four plateaus near Franceville, deep in the interior of the Gabon Republic. A zone of about one square kilometer, selected for exploitation, was expected to yield nearly 9-million tons of ore with output at the scheduled rate of 500,000 tons a year. First ore shipments are planned for 1962.

The project includes an ore processing plant, living quarters, workshops, electric power and other facilities at the mine site. In addition, a 45-mile cableway, with a capacity of 850,000 tons a year, will be built to carry the ore concentrates to a railhead at M'Vinda.

A new 180-mile railroad will be built through the Congo Republic from M'Binda to a junction point near Dolisie on the existing Congo-Ocean RR. that runs to the Atlantic Ocean port of Pointe Noire. Storage and loading facilities for the ore will be constructed at the port.

Total cost of the project is estimated at the equivalent of $89-million. The Work Bank loan will be used to pay for imported goods and services. Remaining costs will be met in part by a loan equivalent to $7-million from the Caisse Centrale de Cooperation Economique—a French Government agency responsible for making development loans in the French Community—and the rest by the shareholders of Comilog.

South African gold mines have been given permission by the Government to sell gold abroad in any form other than in 400 oz bars, which are handled exclusively by the South African Reserve Bank. The move follows growing evidence of international interest in gold as a hedge against inflation.

Response to the announcement has been swift, officials of the Chamber indicate. Less than 48 hours after the announcement, they had already received enquiries for gold to be marketed in "free" form.

IN EUROPE

AUSTRIA

Austrian magnesite exports took a sharp turn for the worse during the first quarter of 1959, resulting in cut production and dismissal of workers. The once-thriving industry, dominated in Austria by two international concerns (one American, one French) suffered greatly under increasing replacement of magnesite, mainly in the iron and steel industry.

Production of magnesite slabs and bricks decreased by one-third during the first quarter of 1959, compared with

MARION POWER SHOVEL COMPANY • Marion, Ohio, U.S.A.
A Division of Universal Marion Corporation

UPGRADING AND SHARP CLASSIFICATION WITH KREBS INTEGRAL 2-STAGE CYCLONES*

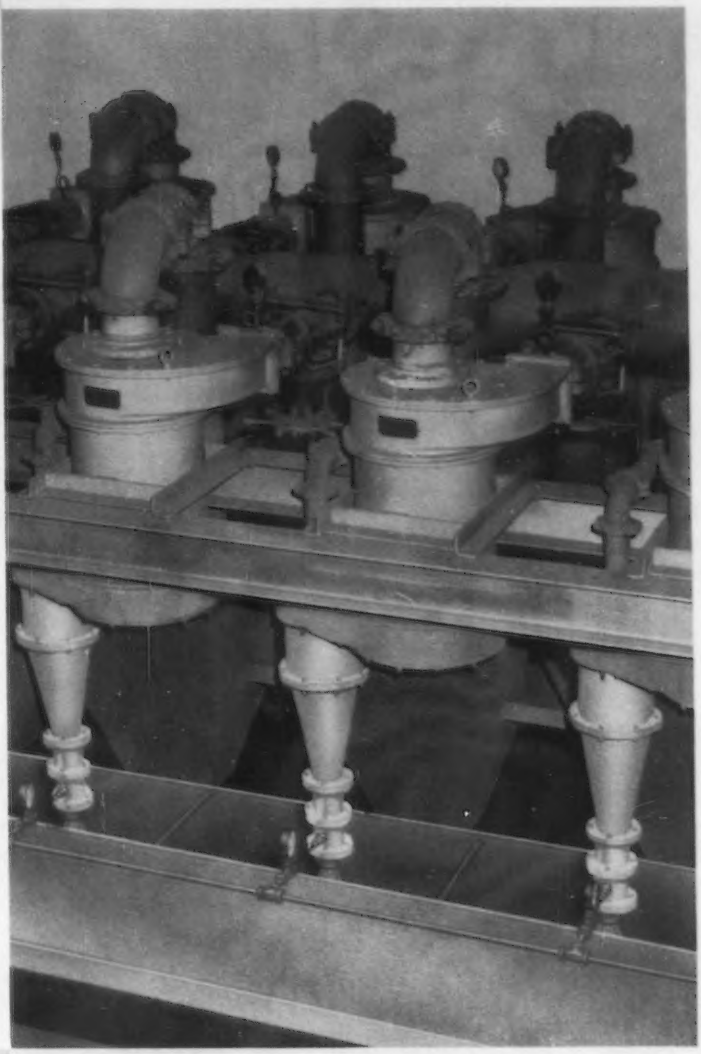
The three-products feature of this cyclone design creates profits by upgrading ores of iron, chrome, manganese, copper, gold, glass-sand, alumina, and other industrial minerals. The Krebs integral two-stage cyclones are a standard method used ahead of spirals for upgrading in iron washing plants—see photo.

Applications are diverse. A copper concentrator uses them on full tonnage, rejecting an essentially minus 15 micron slime from the primary cylinder, with the secondary overflow being the flotation feed, and the small tonnage of underflow reground and recycled.

While most of the 20 Models and the vast majority of Krebs Cyclones in operation are single-stage, 70 plants have installed the two-stage cyclones to obtain the most efficient upgrading.

This is only one of many Krebs Cyclone design developments in the past 10 years. Recent work indicates even wider applications and economic advantages with the Krebs integral two-stage cyclones.

Where upgrading or a sharp classification may be significant to your operations, we invite you to make use of our Pilot Plant facilities and staff of cyclone specialists.



*Patented

EQUIPMENT ENGINEERS INC.

737 LOMA VERDE AVENUE · PALO ALTO, CALIFORNIA

SPECIALIZING EXCLUSIVELY IN CYCLONE TECHNIQUES

George F. Havey
Manchester Sand, Gravel and Cement Co.
Manchester, New Hampshire

"We haven't spent a nickel or a minute on maintenance of our lifetime lubricated rollers and they've been on one D9 more than 1,300 hours. No sign of seal leakage, either!"

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

THERE IS THE RIGHT BIT FOR YOU OUT OF THE MANY POSSIBLE COMBINATIONS OF SIZES AND TYPES

Write today . . . giving all information you can provide. Out of the many combinations possible with four matrices, several stone size ranges, three grades of diamonds, and various face contours we will recommend the bit we believe to be the best suited for your drilling conditions.

Always specify Sprague & Henwood "Oriented" Diamond Bits. They are described and illustrated in Bulletin 320-1.

SPRAGUE & HENWOOD, Inc.
SCRANTON 2, PA.
MEMBER OF: DIAMOND CORE DRILL MANUFACTURERS ASSOC.
New York — Philadelphia — Atlanta — Pittsburgh — Grand Junction, Colo. — Buchans, N.F.

EXPORT SALES: SPRAGUE & HENWOOD INTERNATIONAL CORPORATION, 11 W. 42nd St., N.Y., N.Y.

Austria *(Continued)*

the identical period of 1958. Export of slabs and bricks decreased from 203.8-million Austrian schillings ($7,838,460) in the first three months of 1958 to 82.8-million Austrian schillings ($3,184,610) or by almost 60%. Output of sintered magnesite decreased by about 20%, that of caustic burnt magnesite by 4%. Exports decreased by 25% during the first quarter of 1959, from 69.2-million Austrian schillings ($2,661,500) to 51.8-million Austrian schillings ($1,996,100).

Austria's nonferrous ore enterprises increased output in 1958, compared with the preceding year. Crude aluminum reached 74,200 metric tons of which 75% came from first smelting. Raw lead production increased slightly to 8,900 metric tons due to increased demands from the cable and battery producing enterprises. Electrolytic zinc was produced at a rate of 10,600 metric tons, or 10% above the 1957 level, and electrolytic copper output was increased slightly and reached 9,500 metric tons.

NORWAY

Production of primary aluminum in Norway totaled 120,000 metric tons in 1958, an increase of 26% compared with 95,648 tons produced in 1957. Exports of aluminum from Norway increased 42% during the first 10 months of 1958, compared with the corresponding period of 1957. Low power costs strengthened the competitive ability of the Norwegian aluminum industry.

Annual productive capacity for aluminum was increased by 26,500 tons during 1958; the A/S Electrokemisk's plant in Mosjöen accounted for 22,000 tons and the Norsk Aluminum plant in Hoyanger for 4,500 tons. According to a recent press report, the privately-owned Mosjöen Aluminum Co. is planning to increase capacity to 32,000 tpy. Sixteen new cells are expected to begin producing during the first half of 1959.

SWEDEN

Road building is one of the major projects entailed in the changeover to underground mining now being made by the government-owned Kiruna iron ore mine. Changeover from open pit to underground is scheduled to be completed by 1962. It is expected to be accompanied by an increase in production from the present 10.5-million tons a year to 12.5-million tons. A further goal of 15-million tons is set for 1965. Miners will go to work in buses over paved roads; ore haulage will be by truck, and trackless mining operations will dominate.

IN USSR

A new sub-soil mine will be opened this year at Jushno-Korobkowskij where an-

New!

BOSTON CONCORD IMPERIAL STEAM HOSE with exclusive PATREX TUBE AND COVER plus STAINLESS STEEL BRAID

Two more major product advances by BOSTON establish new standards of performance . . . to meet your most exacting requirements. Here's why they give new Boston Concord Imperial Steam Hose unmatched strength, durability and economy.

PATREX—is the totally new compound from BOSTON research that gives tube and cover extreme heat resistance, amazing flexibility and increased abrasion resistance. Even at 450° F. Boston Concord Imperial shrugs off hardening and cracking that kills ordinary hose!

STAINLESS STEEL INNER BRAID—can't rust in the bore . . . absolutely protects against tube swelling! Two other steel braid barriers embedded in hose wall reinforce Patrex tube for maximum protection against burst. Completely controls pulsating saturated steam pressures up to 250 PSI!

If you want the best, ask your BOSTON distributor about new BOSTON CONCORD IMPERIAL STEAM HOSE. The new golden cover tells you, "It's the most durable steam hose you can buy!"

BOSTON

BOSTON WOVEN HOSE & RUBBER COMPANY
DIV. OF AMERICAN BILTRITE RUBBER CO., INC.
BOSTON 3, MASS.

BASIC PRODUCERS FROM MINE TO FINISHED PRODUCT

COPPER SULFATE

All Crystal Sizes and Powdered

We MINE COPPER and are basic producers of Copper Chemicals—our technical know-how and basic position in Copper is your assurance of exacting quality control, strict uniform consistency and a plentiful competitive supply.

We would be pleased to send you complete information on TC COPPER SULFATE.

TC TENNESSEE CORPORATION

617-29 Grant Building, Atlanta, Georgia

Drying raw ore in a rotary dryer prior to grinding and screening is a new trend in the potash industry. This 5' x 40' rotary dryer built by STANDARD is processing crude ore at the National Potash Co., Carlsbad, N. M. A second Standard dryer is being installed.

This preliminary drying step facilitates full capacity operation of the total plant. STANDARD is equipped to design and manufacture any type of dryer required to meet special needs in industry. Our engineers can help you with drying problems. Write for our new informative dryer bulletin.

STANDARD STEEL CORPORATION

General Offices & Plant, 5060 Boyle Avenue, Los Angeles 58, California

Midwest Offices & Plant LEADER IRON WORKS Decatur 60, Illinois

(Division of Standard Steel Corporation)

ROTARY DRYERS · KILNS · COOLERS · ASPHALT PLANTS

USSR *(Continued)*

nual extraction is to reach 2.5-million metric tons. Two more open-cast mines, scheduled for operation in 1960 are now under construction. The capacity of the two open-cast mines will total 10.5-million metric tons per annum. Jakowlewo is to have another deep mine of 15-million metric tons annual extraction rate by 1965. The work under progress will boost iron ore output in the Kursk Basin by 25-million to 30-million metric tons by 1965.

Iron ore deposits estimated to contain 3.9-billion metric tons — located northwest of Sverdlovsk—are to be worked in what will ultimately be the USSR's largest iron ore processing center. The center is to have a starting capacity in 1963, of 6-million metric tons of concentrates.

The site of the processing center is Katshkanar, where iron ore will be mined by the open-cast method. As a result of easy mining and the short transport hauls, iron ore concentrate from Katshkanar will be the least expensive in the Soviet Union. High-yield machinery is to be installed; aggregates will have a sintering surface of 200 sq m (2,152.78 sq ft), cone crushers will be up to six ft high.

IN ASIA

Eastern Mining & Metal Co. plans to proceed with the development of the iron ore deposits at Ulu Rompin in South Pahang, Federation of Malaya. The project calls for the expenditure of $50-to $60-million during the next four years to bring Rompin iron ore production up to 1.5 to 2.5-million tons annually, all of which is expected to be shipped to Japan. The new source of supply will replace Emmco's Dungun mines, which will be substantially depleted by the time the Rompin project begins producing.

The second of six bulletins has been issued by the Geological Survey H.Q., Federation of Malaya, dealing with airborne magnetometer and scintillation counter survey reports, carried out in 1956-1957. The latest bulletin covers parts of the States of Kedah and Perlis and indicates several areas considered worthy of closer investigation.

Magnetic anomalies, registered in several areas, indicated possible economic mineral deposits occuring at depth, probably within 200-300 ft of the surface. A possible fault or contact zone was indicated with anomalies pointing to possible sulphide mineralization. Other magnetic anomalies were mapped. Of particular interest was a broad magnetic high indicating that the known deposits on Bukit Tupah and Bukit Ahan are only part of the total anomaly.

The report concluded with the comment that most of the areas of interest are already covered by agricultural or mining alienation, or by prospecting licensees (see E&MJ, June 59, p. 410).

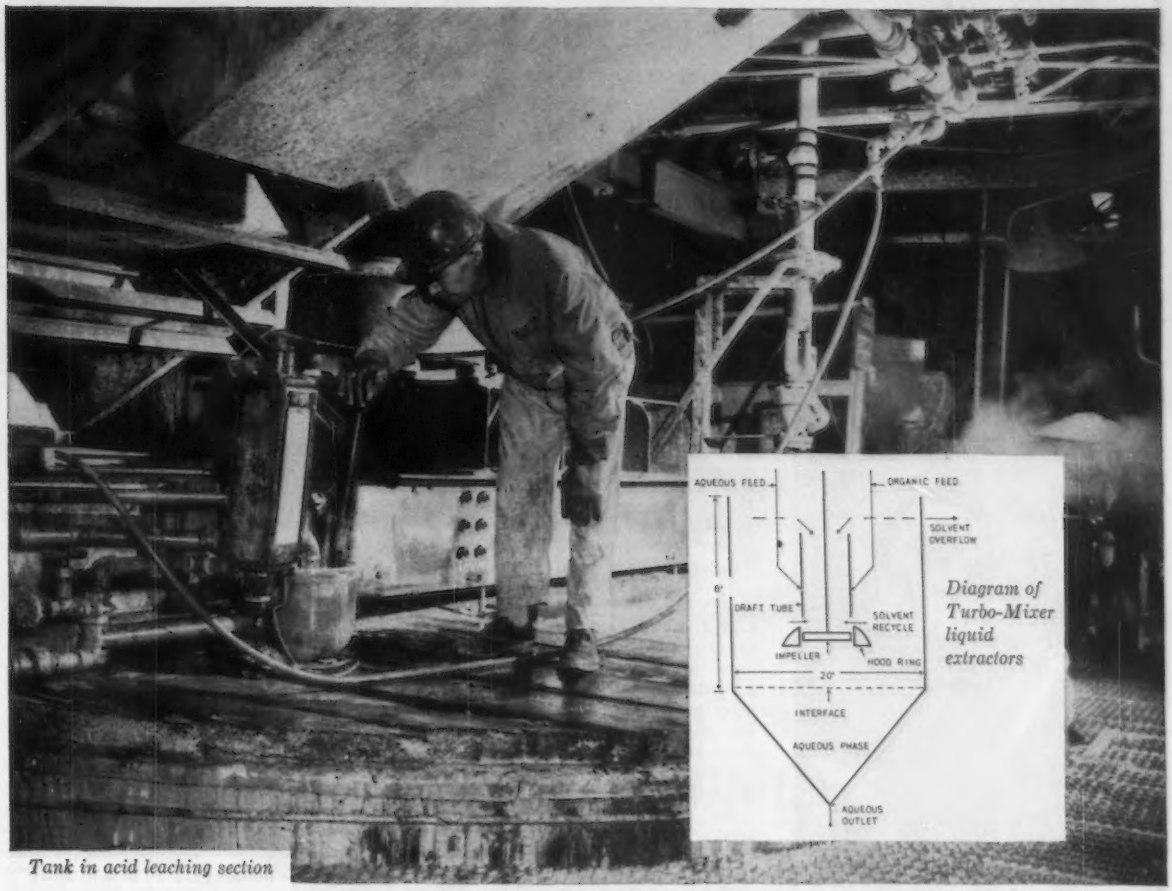


Diagram of Turbo-Mixer liquid extractors

Tank in acid leaching section

VITRO URANIUM HANDLES A WIDE VARIETY OF URANIUM MINERALS WITH TURBO ON THE JOB

When VITRO URANIUM COMPANY of Salt Lake City embarked on a modernization program, they called on GENERAL AMERICAN to assist in the design of the most modern mill possible.

Heart of the plant is the extraction system, and here, GENERAL AMERICAN Turbo-Mixers proved to be key equipment, in both the leaching and liquid extraction sections.

VITRO URANIUM processes a wide variety of uranium minerals which require highly versatile extraction equipment. GENERAL AMERICAN Turbo-Mixers fit this requirement, replacing an outmoded phosphate precipitation operation. Recoveries of uranium fed into the system are "excellent."

As a result of VITRO'S million and a half dollar modernization program, the 660 ton/day mill already has significantly reduced operating costs. Further proof that in processing as in transportation and storage, it pays to plan with GENERAL AMERICAN.

PROGRESS THROUGH BETTER TECHNOLOGY

Blue Ribbon Mining Award

TO: **TURBO-MIXER DIVISION**

GENERAL AMERICAN TRANSPORTATION CORPORATION

FROM: **MINING WORLD/ WORLD MINING**

FOR: Achievement In Equipment Development Aiding the Technological Advancement of the Mining Industry.

Write for General TURBO-MIXER BULLETIN

Process Equipment Division

TURBO-MIXERS

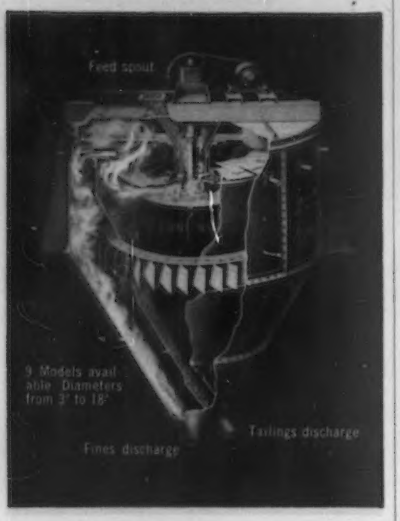
GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street

Chicago 90, Illinois • Offices in principal cities

TURBO-MIXER GENERAL AMERICAN TRADE MARK

In Cement and Aggregates the Word for Air Separation is "Sturtevant"



in cement . . .

Sturtevant Air Separators make possible highly efficient closed-circuit systems. Large circulating loads increase output, eliminate overgrinding. Ball and lining life lengthens, power costs are lowered. Top quality cement results from precise control of finenesses. Standard 16 ft. Sturtevants deliver raw fines up to 70 tph, finished fines up to 260 bph.

in aggregates . . .

Sturtevant Air Separators classify sand without water, clean sand by de-dusting it. Pre-classification by air can also increase screening production by removing screen-blinding fines. In blending operations, Sturtevants select desired fines from grinder throughput. This graded product is then used to overcome fineness modulus deficiencies.

Send for Air Separator Bulletin No. 087.

STURTEVANT
MILL COMPANY
101 Clayton St., Boston, Mass.

Crushers • Grinders • Micron-Grinders • Separators
Blenders • Granulators • Conveyors • Elevators

PERSONALS

McGraw Succeeds Coash as E&MJ Publisher

Carl J. Coash (left), publisher of ENGINEERING & MINING JOURNAL, COAL AGE, E&MJ METAL & MINERAL MARKETS, and KEYSTONE COAL BUYERS MANUAL, has been appointed Ohio District Manager and regional vice president of the McGraw-Hill Publishing Co., Inc.

Donald C. McGraw, Jr. succeeds him as publisher of the mining magazines.

Mr. Coash graduated from the University of Illinois in 1928, and served the state as an inspector of engineering and highway construction. He then joined the F. W. Dodge Corp. and, in 1939, was named St. Louis district manager for Sweet's Catalog Div.

In 1944, Mr. Coash joined McGraw-Hill as advertising salesman for E&MJ, Coal Age, and Factory. He became the Chicago district manager in 1947, moved to New York in 1953 as the publications' advertising sales manager, and became publisher on April 1, 1955.

Mr. McGraw joined the company in 1950 as an advertising salesman on Product Engineering. He later became associate manager of the Eastern Sales District, assistant director of advertising and advertising sales manager of the company's mining publications. Since September 1958, he has been associate publisher of Industrial Distribution.

John Lentz is the new manager of Phelps Dodge Corp.'s Morenci, Ariz., division, succeeding **Lyle M. Barker** who is retiring.

Lentz joined PD in 1955 as a mining engineer at Ajo, Ariz. He was promoted to chief engineer of the New Cornelia branch in 1946, to mine superintendent in 1949, and to general superintendent of Ajo properties in 1955.

He was transferred to the Morenci division as general superintendent in 1957.

Fred H. Bunge, supervisor of research for M. A. Hanna Co., was elected chairman of the beneficiation sub-section of the Minnesota AIME for the coming year. **R. C. Ferguson,** district manager for Hardinge, Inc., became vice-chairman and **Richard A. Derby,** development engineer for Oliver Iron Mining Div., was chosen secretary-treasurer.

Mrs. Belle A. Gemmell, 96, one of the west's first women doctors and the widow of **Robert C. Gemmell,** an associate of the late **Col. D. G. Jackling** in the development of the Bingham open cut copper mine of Utah Copper Co., was recently honored by her family at Murray, Utah.

Mrs. Gemmell was born June 7, 1863 at Salt Lake City, received her M.D. degree from the University of Michigan in 1884, and married Mr. Gemmell in 1888.

Mr. Gemmell succeeded D.C. Jackling as general manager of Utah Copper—holding that position until his death in 1922.

Edward Renouard, Anaconda's western operation's vice president, has been named chairman of the program committee for the 1959 Metal Mining & Industrial Minerals Convention of the American Mining Congress to be held at Denver on Sept. 14-17.

C. J. Hamilton, Coeur d'Alene attorney, has been re-elected president of the Lincoln Mining Co.

S.E. Jerome is the new northwest district geologist for Bear Creek Mining Co., a subsidiary of Kennecott Copper Corp.

He had previously served in Salt Lake City with Bear Creek's coordinating unit as district geologist for three years.

Virgil E. Hale, a miner at the Hecla Mining Co.'s Livingston mine near Challis, Idaho, has been awarded the medal

Why the "built-in values" of General Electric Mining Cables are so important to you

"Built-in values" make General Electric cables outstandingly successful in meeting the needs of the mining industry. These values result from designing, engineering, and building into these cables carefully developed and selected components and particular construction advantages.

Three examples of these important values are:

Two-layer reinforced lead-cured jackets. Here's how the jackets of G-E portable mining cables are made to resist abrasion, pulling, crushing, and twisting: 1) *Lead curing* gives a dense, tough jacket with added longitudinal and radial mechanical strength; 2) a strong, *twine open mesh* is built in as an integral part of the jacket to provide greater over-all tensile strength and radial strength in order to reduce displacement of the core members.

Flexible conductors that reduce breakage. Flexibility and long service life are achieved by special rope concentric stranding of conductors, developed through years of testing and field service.

Insulation with toughness and crush-resistance. Insulation for 600-volt cables, for example, is a GRS heat-resistant rubber compound with excellent electrical characteristics and the necessary mechanical toughness and resiliency for the severe conditions encountered in mining applications.

All General Electric mine cables bear the embossed symbol P-108 of the Pennsylvania Department of Mines, and where required also carry the BM marking indicating listing by the United States Bureau of Mines.

To get complete information about G-E mine cables, mail the coupon for new, up-to-date brochure.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Company
Wire and Cable Department
Section W230-895
Bridgeport 2, Connecticut

Please send me your new booklet on General Electric Portable and Power Cables for the mining industry.

Name_____

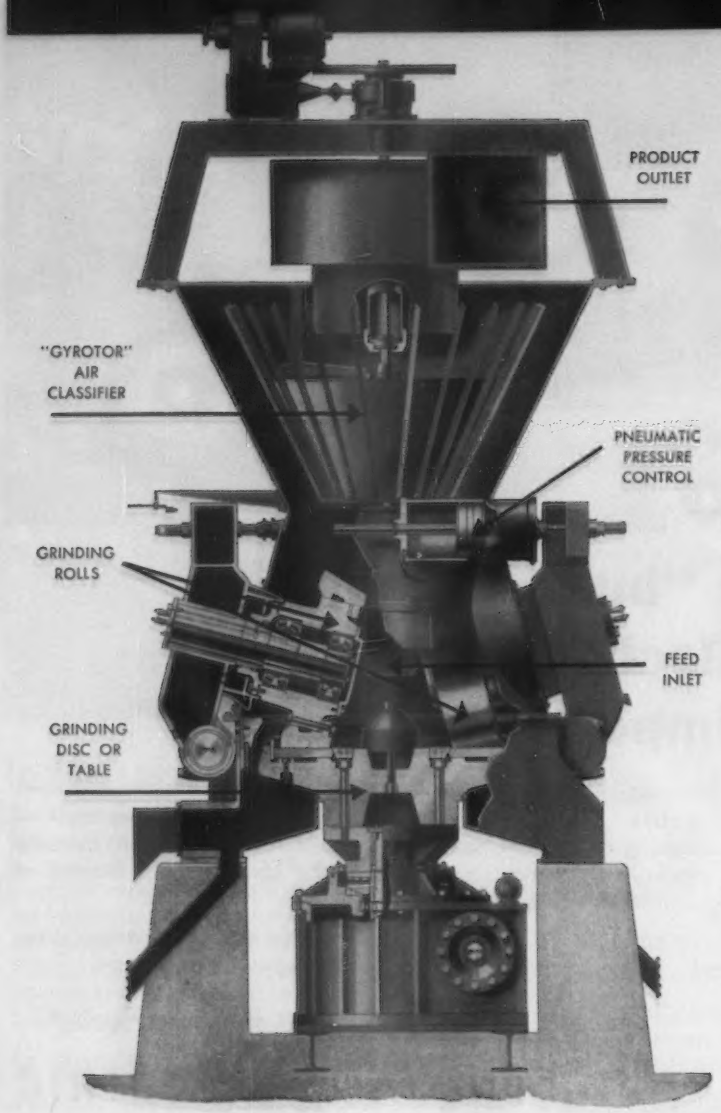
Title_____

Company_____

Street_____

City_____ Zone_____ State_____

DISC-ROLL MILL



The Hardinge Disc-Roll Mill is applied to dry grinding of minerals such as talc, limestone, coal, phosphate rock, bauxite, clays, celestite, and gypsum.

The Disc-Roll Mill incorporates pneumatic roll-loading. Since the pressure on the rolls can be released or increased at will, complete flexibility of operation results. The problem of over-loading is eliminated. Also, the Hardinge "Gyrotor" Classifier is standard equipment on the Disc-Roll Mill. This classifier provides very close control of the finished product over a wide range of sizes. Ask for Bulletin 52-1.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 ARCH ST. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco • Birmingham • Jacksonville Beach

Personals *(Continued)*

of honor of the U.S. Bureau of Mines for heroism in a fire at the Livingston last year. The citation went to Hale for risking his life by climbing 225 ft down the shaft to the mine's 2700 level and then, aided by a dim flashlight, guided two fellow workmen to safety through the smoke of the fire that destroyed the mine's surface plant.

William H. Love, general manager of the Hecla Mining Co., and **Angus Bethune,** Kellogg, manager of metallurgy for the Bunker Hill Co., have been added to the board of directors of the Northwest Mining Assoc. at Spokane, Wash. Also added to the board was **John Currie,** resident manager of the American Zinc, Lead & Smelting Co. at Metaline Falls, Wash.

H.F. Alvord has been appointed assistant to the manager of industrial relations for the Colorado Fuel & Iron Corp., according to **Howard J. Jones,** manager of industrial relations.

Alvord was previously superintendent of industrial relations at CF&I's Pueblo plant. He is succeeded there by **John H. Stenmark** who was formerly assistant superintendent.

Alvin D. Grinde, master mechanic at the South Agnew and Morton mines for the M.A. Hanna Co., has been promoted to assistant supervisor of mobile equipment for the company with headquarters at the Hibbing district office.

Robert M. Slipp and **Alfred R. Allen** are heading an engineering team which is reactivating the Canadian Creek Placers Ltd., a mining development which had its start in the gold rush days before the turn of the century. The property is located on Canadian Creek about 90 miles from Dawson City.

David L. Scott recently became plant manager at Mound Laboratory, Miamisburg, Ohio, which Monsanto Chemical Co. operates for the AEC.

Scott succeeds **Edward C. McCarthy,** who has accepted the position of manager, silicon project, with the development department of Monsanto's inorganic chemicals division at St. Louis.

Dr. Eugene A. Rembold, research section leader with the company's plastics division, will replace Scott as production superintendent at Mound.

The Hon. P.A. Delme'-Radcliffe and **D.R. Mitchell** were elected president and vice president at the 48th annual meeting of the Federation of Malayan State's Chamber of Mines held May 28 at Ipoh, Malaya.

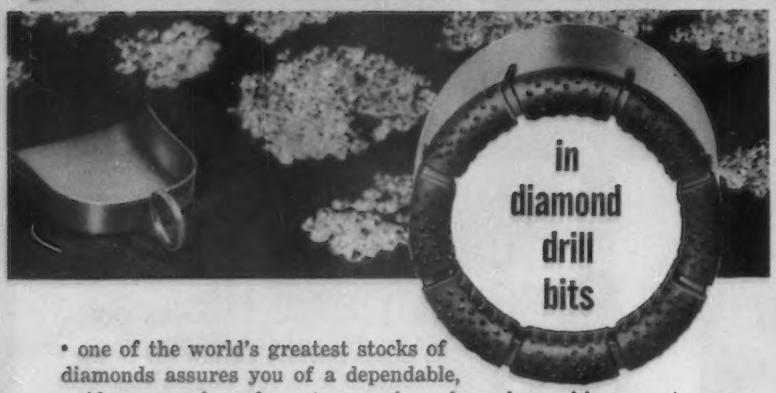
According to a recent release from McGraw-Hill World News, an eight-man team from the International Atomic Energy Agency will visit Latin America in response to requests from Argentina, Brazil and Venezuela for advice on the development of various aspects of their atomic energy programs.

Edward R. Trapnell, special assistant to IAEA's director general, will head the team. He has spent more than thirteen

Personals *(Continued)*

Hold fast in hard rock!
O-B Shells and Plugs
When you anchor your bolts with O-B Shells and Plugs, you get top holding power in hard rock.
Under tension these units build up a solid "socket" of tough malleable iron that expands in four directions into the wall of the bolt hole—distributing expansion forces evenly, keeping unit stresses comparatively low even at very high tension. Today, more mines are bolting with these O-B Shells and Plugs than ever before!
OHIO BRASS CO., MANSFIELD, O.
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.
Ohio Brass
HOLAN
EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS
4945—M
O B
SHELLS AND PLUGS

DTR for DEPENDABILITY



• one of the world's greatest stocks of diamonds assures you of a dependable, uniform supply • honest, experienced workmanship • custom designing to suit your requirements • completely reliable performance of bits • prompt delivery • an earnest effort to help reduce your footage costs . . . including expert consultation with people who know your problems *we do no contract drilling*

write for our interesting and informative free brochure on industrial diamonds

DIAMOND TOOL RESEARCH CO., INC.
380 Second Avenue, New York 10, N. Y. GR 5-3530

Specialists in Quality Industrial Diamond Products • Diamond Grinding Wheels • Dressers • Abrasives • Hones • Blades • Cutting Tools • Drills.

No other book like it!

"INDUSTRIAL MINERALS and ROCKS"

3rd Edition—Completely Revised!

Here is the standard reference book on nonmetallic mineral occurrence, mining, preparation for market, uses, and vital statistics. Its significance to engineers and executives makes it a must in the reference library of every firm in the minerals industry.

This unique volume has 55 chapters . . . covering the widest possible range of industrial minerals and rocks, from abrasives to zircon.

Dr. Joseph L. Gillson, recognized authority on industrial minerals, President-elect of AIME, is editor-in-chief . . . aided expertly by an editorial board of leaders in each field.

This brand-new edition has been completely rewritten. So much new material has been added that the format has been enlarged. All maps, drawings and pictures are new.

The publication price of this important source book is $12. Copies will be available in September. Mail the coupon below *now*, to secure a copy as soon as possible. (Extra postage to addresses outside the United States, 50¢ per copy.)

American Institute of Mining, Metallurgical and Petroleum Engineers
29 West 39th Street, New York 18, New York

Please send me ———— copy (copies) of "Industrial Minerals and Rocks."

Payment in the amount of $———— is enclosed.

Name .....

Street .....

City ..... State .....

Personals *(Continued)*

years with the U.S. Atomic Energy Commission, American industry and the International Agency.

The remaining seven members of the mission include:

André Gerstner, acting chief of the Research Div. of Vendee of the French AEC's mining and research department who has worked in French Guiana and is familiar with the geology of areas similar to those to be visited by the group:

Rudolph Höfer, expert on medical uses of radioisotopes and head of the radioisotope laboratory of the Second Medical University Clinic, Vienna;

D.G. Maxwell, consulting metallurgist for the General Mining & Finance Corp., Johannesburg, South Africa;

A. C. Schuffelen, specialist on radioisotope's agricultural applications, and attached to the laboratory of soils and fertilizers, University of Agriculture, Wageningen, Netherlands;

Joaquin Catala of IAEA's division of exchange and trading, former dean of science, Valencia University, Spain;

Subhas K. Dhar, member of IAEA's division of economics and technical assistance;

Vladimir Shmelev, member of IAEA's reactor division and formerly on the staff of USSR's first atomic power station.

Robert G. Doyle has been appointed Maine's new state geologist, replacing John R. Rand who returned to private practice.

Doyle

Doyle came to the Maine survey last July as assistant to Mr. Rand. Previous to that time he had been a staff geologist with the St. Joseph Lead Co.

Mr. Doyle graduated from Harvard University and spent several years in South America as an exploration geologist.

Martin K. Hannafin became manager of mines for the Anaconda Co. in Butte on July 1. He succeeds **Edward Renouard** who became vice president in charge of western operations. (E&MJ, July 1959, p 160).

Hannafin was assistant general superintendent of mines.

John W. Eason recently became manager of the Baltimore Div. of Revere Copper & Brass Inc., according to **James M. Kennedy,** board chairman. Eason has been manager of Revere's aluminum industry sales since October 1947 and previously was manager of aluminum sales at Baltimore.

As head of the Baltimore division, Mr. Eason succeeds **Jack F. Croasdale,** a Revere vice president, who died suddenly on June 19.

Eason joined Revere in 1944 and served as a technical advisor on aluminum products for the Baltimore Div. until January 1946.

Preferred

BY LEADING MINE LABORATORIES!

BAKER & ADAMSON B&A QUALITY STANDARD OF PURITY

REAGENTS

America's foremost line of laboratory and scientific chemicals

Here's why so many mine laboratories use B&A Reagents: Because they are always dependable, uniform and pure. Because they meet and in many cases exceed A.C.S. specifications. Because you can call on B&A for a *complete* line of laboratory chemicals and "C.P." Acids. And because you can count on quick, convenient service from B&A stocking points and leading mine supply wholesalers. Specify B&A for *all* your laboratory reagent needs, including:

- C.P. Acids and Ammonium Hydroxide
- Aluminum Nitrate, Reagent
- Ammonium Chloride, Reagent, A.C.S.
- Ammonium Nitrate, Reagent, A.C.S.
- Ammonium Thiocyanate, Reagent, A.C.S.
- Barium Chloride, Reagent, A.C.S.
- Bromine, Reagent, A.C.S.
- Carbon Tetrachloride, Reagent, A.C.S.
- Chloroform, Reagent, A.C.S.
- Cupferron, Reagent, A.C.S.
- Ethyl Acetate, Reagent, A.C.S.
- Filter Paper
- Hydrofluoric Acid, 48% Reagent, A.C.S.
- Lead Metal, Reagent, A.C.S.
- Lead Nitrate, Reagent, A.C.S.
- Lead Oxide, Mono, Reagent (Litharge)
- Lithium Fluoride, Reagent
- Methyl Alcohol, Reagent, A.C.S.
- Perchloric Acid, Reagent, A.C.S.
- Phosphoric Acid, Ortho, 85% Reagent, A.C.S.
- Potassium Chlorate, Reagent, A.C.S.
- Potassium Iodide, Reagent, A.C.S.
- Sodium Chloride, Reagent, A.C.S.
- Sodium Fluoride, Reagent
- Sodium Thiocyanate, Reagent, A.C.S.

Available in all major mining areas through

Arrowhead Chemicals and Exterminators, Inc.—Minnesota
Coeur d'Alene Hardware and Foundry Co.—Idaho
Industrial Chemical & Supply Company—Florida
Mine & Smelter Supply Company Colorado—Texas—Utah
Montana Hardware Co.—Montana
Northwest Chemical Laboratories, Inc.—Montana
B. Preiser Co.—Ky., W. Va.
Reading Scientific Company—Pa.
Tech. Scientific Supply Company Miami, Florida
Western Chemical Co.—Arizona

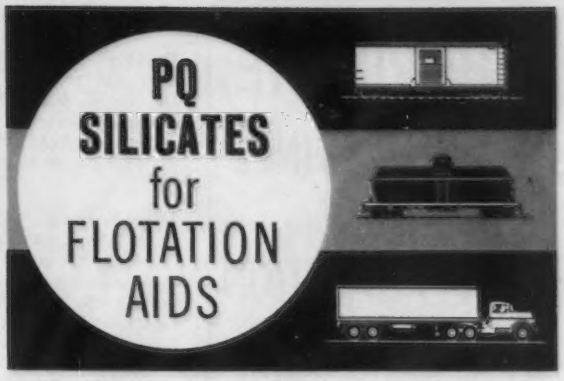
Complete line of Baker & Adamson products available from General Chemical sales offices everywhere!

BAKER & ADAMSON® Reagents

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N. Y.

PQ SILICATES for FLOTATION AIDS



The silicates are efficient, economical dispersing agents, depressants and surface conditioners. Let us discuss how PQ silicates may improve your recoveries.

Our catalog lists 40 silicates (liquid, solids, hydrated and anhydrous powders). You are sure of getting the right one for your operations.

Fast deliveries in bulk or carload and truckload in drums are available from our plants in Anderson, Indiana; Buffalo, N. Y.; Baltimore, Md.; Chester, Pa.; Jeffersonville, Ind.; Kansas City, Kansas; Rahway, N. J.; St. Louis, Mo.; Utica, Ill.

When it's silicate service you need, contact PQ.

PHILADELPHIA QUARTZ COMPANY
1135 Public Ledger Building, Philadelphia 6, Pa.

PQ SOLUBLE SILICATES

USE THIS RELIABLE SILICATE SERVICE SOON

Trademarks Reg. U.S. Pat. Off.

FIND CRACKS QUICK!

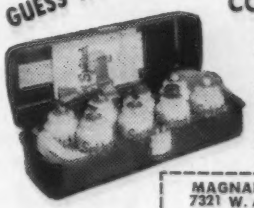
USE **Spotcheck®**

THE DYE PENETRANT INSPECTION IN SPRAY-ON CANS BY MAGNAFLUX

POSITIVE
QUICK TEST
ENDS
VISUAL
GUESS WORK!

Spotcheck detects cracks, leaks, porosity you can't see (any defect open to the surface). Saves you money and trouble! Use on any metal—also carbides, ceramics, plastics, etc. Spray on Spotcheck for quick, everyday "in-process" and maintenance inspection. Hundreds of users rely on Spotcheck. Spotcheck materials are the LOWEST COST DYE PENETRANTS. All substitutes cost more.

COMPLETE Spotcheck KIT



$36.00 U.S.A. ONLY F.O.B. our plant, Chicago, Ill.

Everything you need for dye penetrant inspection in handy, lightweight Fibreglass carrying case. 2 spray cans Penetrant, 2 spray cans Developer, 4 spray cans Cleaner. Instruction book and cleaning cloths.

MAGNAFLUX CORPORATION
7321 W. Ainslie Ave., Chicago 31, Illinois

☐ Please send me____SK-3 kits at $36.00 each, plus $1.00 each packing and shipping.
☐ Send FREE bulletin only. Includes low Spotcheck material prices.

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

"LUBRIPLATE, THE OUNCE OF PREVENTION"

says
VULCAN IRON WORKS, INC.
of Chicago, Ill.

—a leading manufacturer of pile driving and extracting equipment

"For many years we have used LUBRIPLATE Lubricants for shop assembly, and have recommended them to our customers through your LUBRIPLATE Tag Plan. Our experience shows that if the proper lubricants are used from the beginning, there are fewer problems and parts replacements later. We consider LUBRIPLATE to be the best possible ounce of prevention."—
H. G. Warrington, Vice-Pres.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE GREASE AND FLUID TYPE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

Personals (*Continued*)

David W. Mitchell has been named coordinator, research and production, by **Dr. E. M. Kipp,** director of research, Foote Mineral Co. In addition to his new assignment, Dr. Mitchell will continue to act as manager of minerals research.

James S. Dodge recently returned to this country from an examination of French uranium deposits in the Central Massif area following six months of geological exploration in Southern Rhodesia. Mr. Dodge is president of Aspen Mines, Inc., and in addition to his consulting and geologic exploration work, will supervise development of the company's uranium deposit near Aspen.

Appointments of **Daniel P. Griffin, Thomas Wigal** and **Kirby Crowley** to new positions with Anaconda Co. in Butte were announced by **E.L. Renouard,** vice president in charge of western operations.

Mr. Griffin will become personnel director for Butte operations, Mr. Wigal will be manager of the company's communications department and Mr. Crowley will be training supervisor for Butte operations. He will also assist in setting up and operating training programs a other company locations ii the West.

Arhur B. Nelson, former Mullan, Idaho mining man, has returned from Matahambre, Cuba, where he was general manager of mines. He will accept a position with the U.S. Government as advisor in metallurgy to Brazil.

George D. Dub retired from Cyprus Mines Corp. and as president and general manager of Colorado Copper & Zinc Co. on July 1. He will resume consulting engineering practice in Los Angeles.

Five Colorado School of Mines' alumni were given distinguished achievement medals during the college's 85th annual commencement. They were:

George Wooding Clarke, engineer of mines—1923, vice president, director and division manager, the Pan American Petroleum Corp., Oklahoma City;

Kuno Doerr, Jr., metallurgical engineer—1927, president, director and general manager, the Southern Peru Copper Corp., Toquepala, Peru;

Theodore Marvin, engineer of mines —1922 and master of science—1923, president and chairman of the board, the Michigan Chemical Corp., St Louis, Mich.;

Robert Summers Stockton, engineer of mines and metallurgy—1895, retired superintendent of operation and maintenance for the Canadian Pacific RR and former Mines faculty member, Spokane, Wash.; and

Robert Reese Williams, Jr., metallurgical engineer—1929, manager of mines, the Colorado Fuel & Iron Corp., Pueblo, Colo.

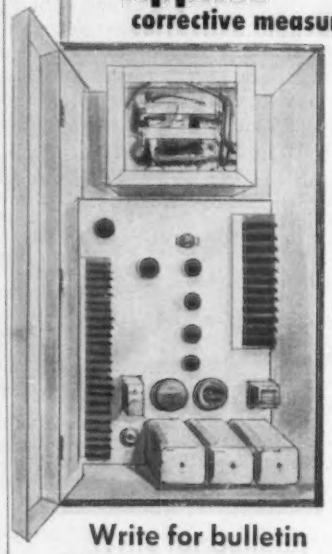
The medal is the highest honor which Mines bestows on a graduate and is equivalent to the honorary doctor of engineering degree.

A Blue Ribbon Winner

TRANSIST - O - TROL

Senses position of materials . . .

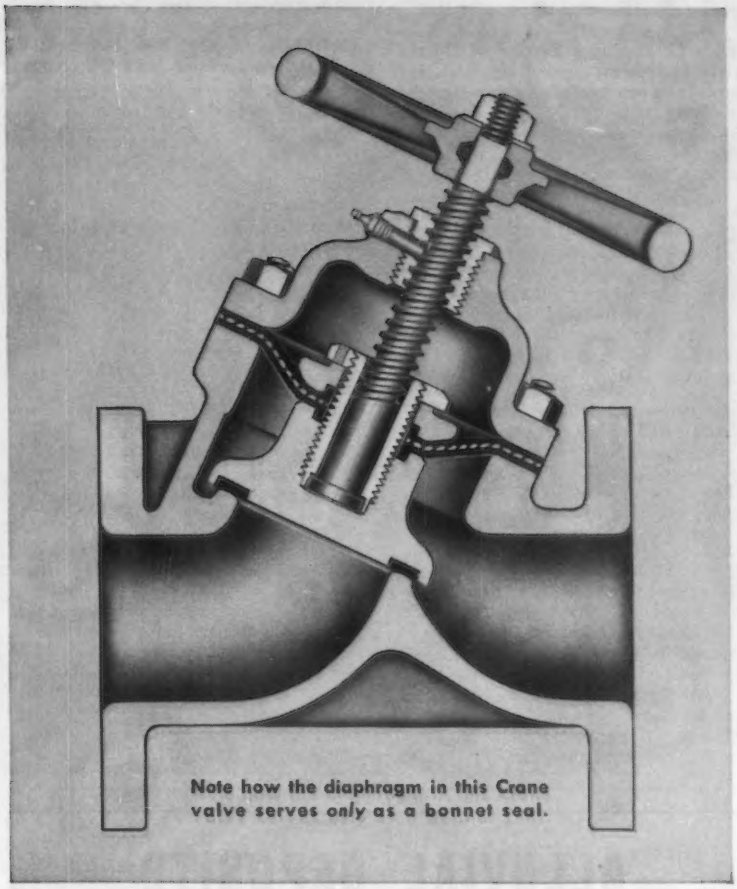
- **Controls** equipment
- **Signals** equipment failure
- **Applies** corrective measures



Write for bulletin

Industrial Physics & Electronics Company

470 South 10th East
Salt Lake City 2, Utah
Phone DAvis 8-8678



Note how the diaphragm in this Crane valve serves *only* as a bonnet seal.

Crane screwed-end diaphragm valve: ½" to 2". Flanged ends: ½" to 14". Four body materials; five trims. Special body and trim materials available on order.

Lined valves—flanged ends only. Neoprene and hard, natural rubber linings regularly available. Other linings on special order.

Crane separates disc and diaphragm to make diaphragm valves last longer

NOW IN SIZES UP TO 14 IN.

The diaphragm in ordinary valves is stretched to serve as a disc as well as a bonnet seal. This makes it vulnerable to crushing, cutting and abrasion. Result: accelerated wear . . . threat of rupture . . . frequent diaphragm replacement.

Not so with Crane diaphragm valves. The diaphragm has only *one* function: sealing the bonnet against line fluids. Result: diaphragm lasts longer—there's less valve maintenance cost. The disc is a *separate unit* and shuts off flow even if the diaphragm should fail.

Typical added Crane features

Y-pattern body offers least resistance to flow, minimizes pressure drop . . . *flat-faced disc* with durable, resilient insert ring resists erosion; seats tightly . . . valve operation requires lower torque; fewer turns.

Handle all types of fluids

Crane diaphragm valves are available for a wide variety of services—from water, air and gas to corrosive, volatile and hard-to-hold liquids. They are supplied regularly with bronze, cast iron, aluminum or stainless steel body—with neoprene, buna N, natural rubber, Kel-F or Teflon trim. Neoprene or hard, natural rubber lined valves also supplied. Other body materials, trims and linings on special order.

Ask for new Bulletin AD-1942

For complete details, consult your Crane Representative or write to address below for bulletin.

CRANE® VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Illinois—Branches and Wholesalers Serving All Areas

VENTILATE THE WORKING FACE!

THE BEST VENTILATED CROSS-CUTS WILL NOT DO THE JOB!

ABC MINE VENTILATION FLEXIBLE TUBING

GETS THE AIR TO THE WORKING FACE!

NEOLON AND MINE VENT TUBING

weigh far less, cost less, are easier to erect than metal pipe. No denting or rusting. NEOLON is synthetic rubber coated nylon — can't tear, corrode or mildew. Mine Vent has jute canvas base. Both are easy to couple, hang and store. Readily follows contour of mine wall. 8" to 26" dia. 25' 50' and 100' lengths.

NEOLON AND MINE VENT WIRE REINFORCED TUBING

For pulling foul air and dust away from the working face. Easily installed in horizontal or vertical position.

Send for Catalog

ABC AMERICAN BRATTICE CLOTH CORP.

220 ARGONNE RD. WARSAW, IND.

Personals *(Continued)*

Marion G. Mastin, a director of Hydrometals, Inc., fabricators of zinc and zinc alloys, has been named vice president of the corporation.

Mastin is a consulting chemical engineer with headquarters in Riverside, Conn., and will act as technical director of Hydrometals on a consulting basis.

Harold Banta, who for many years has been legal representative for numerous mining operations in northeastern Oregon, has been appointed a member of the governing board of the Oregon Department of Geology and Mineral Industries. He succeeds **Miss Nadie Strayer,** Baker, Ore., whose term expired.

Lester Crow, former member of the engineering staff of the Bunker Hill Co. at Kellogg, has taken a position as mining technology advisor of the government technical institute of the Union of Burma. He has contracted for a two-year stay.

Three organizational changes at the Ruston smelter of the American Smelting & Refining Co. have been announced by **R. E. Shinkoskey,** plant manager.

Martin L. Plass has been promoted from assistant general superintendent to the newly-created position of operations superintendent.

Charles H. Randt, formerly assistant manager, has been promoted to smelter superintendent, where he will be in charge of docks, mills, furnaces and the sulphuric acid plant.

W. Clyde Leonard, with the company for 29 years, has been promoted to refinery superintendent.

Charles H. Dewey and **Joseph R. McVicker** have been placed in charge of Republic Steel Corp.'s northern iron ore and company's coal mining operations, respectively, **E. R. Johnson,** vice president in charge of operation, recently announced.

OBITUARIES

Carlton B. Smith, 63, director of service for Allis-Chalmers Industries Group, died July 6 in Milwaukee.

Smith became manager of the service and erection department in 1951 and director of service in 1957.

Roy H. Kinsbury, who had been identified with the mining industry in Idaho for 59 years as an officer or director of at least a dozen mining companies, died recently in Wallace at the age of 82.

He was a former purchasing agent of the old Federal Mining & Smelting Co. and for a number of years before going into the brokerage business at Wallace was chief accountant for the Interstate-Callahan Co. at the Interstate mine.

ALLUVIAL DEPOSITS

Gold-Tin-Columbite-Ilmenite-Bauxite Rare Earths

Most accurately and economically tested for . . . with the

EMPIRE DRILL

NEW YORK ENGINEERING COMPANY

75 West St., N. Y. City, U.S.A. Cable Address NYECO, N.Y.

CONTRACT CORE DRILLING

EXPLORATION FOR MINERAL DEPOSITS
INCLUDING URANIUM & LIMESTONE — ANYWHERE

FOUNDATION TEST BORING • GROUT HOLE DRILLING

Skilled crews and complete stock of core drills and accessory equipment maintained at all times

Core Drill Contractors for more than 60 years

JOY MANUFACTURING CO.
Contract Core Drill Division
MICHIGAN CITY, INDIANA

speedy, versatile ALL-WORK UNIT

the all new

6500-lb. capacity CASE W-10

Today's increasingly high overburden ratios make efficient tonnage-handling a definite must for profitable open pit mining. For savings in clean-up work around your big shovels and for fast handling of in-plant materials, it will pay you to investigate the following performance advantages of the rugged, highly maneuverable Case W-10.

X GREATER WORK OUTPUT

Balanced power-to-weight ratio . . . insures top all-around efficiency . . . with minimum wheel slippage.

X FAST, SMOOTH OPERATION

50% more weight on rear wheels when empty, eliminates bucking and bouncing . . . gives greater ground-gripping traction. Powerful break-out, gets heaping loads fast.

X LONGER LIFE

Balanced, heavy-duty construction results in less strain on engine and transmission . . . provides maximum strength and rigidity.

X EASIER SERVICING

Brake, electrical and steering systems are all easily accessible. Engine design permits servicing without removal.

X SAFER HANDLING

Loader arms pivot ahead of operator . . . unequalled visibility, maximum operator safety. Low center of gravity and wide-tread stability mean bigger loads at higher speeds . . . no tipping.

X LOWER COST

With all its advanced features, the W-10 is priced lower than its nearest competitor.

CASE®
J. I. CASE CO., RACINE, WIS.

Find out for yourself what the new W-10 can do on your job. Your Case Industrial Dealer will arrange a demonstration. Call today or mail coupon.

WORLD-FAMOUS 100 HP CASE DIESEL
gives you better performance with greater economy

★ **POWRCEL combustion**— cleaner burning, smoother running, greater economy.
★ **Six-point fuel filtration,** plus dry-type air filter which reduces dirt intake more than 90% over oil-bath cleaners.
★ **Extra-heavy, ribbed engine block** — gives more rigid engine, reduces flexing and results in less internal wear.
★ **Heavy-duty 7 bearing crankshaft** — with 116 sq. in. of bearing surface . . . more than any other engine in its power class.
★ **Pressurized cooling** — for uniform temperature control.
★ **Multiple cylinder heads** — prevent warping, make servicing easy.

J. I. CASE COMPANY
DEPT. H1379, RACINE, WIS.

- ☐ Send more information on new W-10 Terraload'r. Also send literature on:
- ☐ 3000-lb. cap. W-5 Terraload'r
- ☐ 6000-lb. cap. W-9 Terraload'r
- ☐ Crawler tractor-shovels . . . cu. yd. cap.
- ☐ Crawler dozers
- ☐ Have nearest dealer call

Name .....
Title .....
Company .....
Address .....
City ..... Zone..... State.....
C-TL-373

PROFESSIONAL SERVICES

Assaying • Consulting • Prospecting • Ore Testing
Research • Metallurgy • Mill Design • Mine Department

AGENCE MINIERE ET MARITIME
Sworn Weighers and Samplers of Ores-Metals-Residues
Stevedoring-Storage-Shipping
2, Van Breestr. Antwerp (Belgium)
Tel.: RENTIERS—Telex: 3169.

JOHN L. ALEXANDER
Mining Consultant
MEXICO
Apdo. Postal 54
Caborca, Sonora, Mexico
Telephone #9

BEHRE DOLBEAR & COMPANY, INC.
Consultants
Mining Geological and Metallurgical
11 Broadway, New York 4, N. Y.
Cable Address—BEHRDOL

EDMUND C. BITZER, E. MET.
Mill Design and
Operations Consultant
1118 18th Street
Golden, Colorado
Phone CHestview 9-4011

COWIN & COMPANY, INC.
Mining Engineers & Contractors
Shaft & Slope Sinking
Mine Development
Mine Plant Construction
1—18th Street S.W. Birmingham, Ala.
Phone ST6-5566

DICKINSON LABORATORIES
Assayers—Chemists
Metallurgists—Umpier Work
Ore Shippers representatives at Local Plants
Sampler-Analysts at Mexican Border Points
1300 West Main St. El Paso, Texas

FRANCIS H. FREDERICK
Consulting Mining Geologist
690 Market Street
San Francisco 4, California
Telephone: SUtter 1-1562

ABBOT A. HANKS, INC.
Assayers—Chemists
Est. 1866
Spectographic Analysts
Shippers Representative
1300 Sansome Street San Francisco 11

E. LEE HEIDENREICH, JR.
Consulting Engineers
Crushing Plants — Quarries
Milling Plants — Plant Design
Plant Layouts — Appraisals
75 Second St., Newburgh, N. Y.
9 So. Clinton St., Chicago 6, Ill.

HERON ENGINEERING CO.
Consulting Engineers for all types of Aerial Tramways, Cableways and Suspension Structures.
200 South Acoma St.
Denver 23, Colorado

KELLOGG KREBS
Metallurgical Engineer
Mineral Dressing Consultant
564 Market St., San Francisco 4, Calif.
Telephone: SUtter 1-6613

KIRK & COWIN, INC.
Consulting - Reports Appraisals
1—18th Street SW
Birmingham, Alabama

LAKEFIELD RESEARCH LIMITED
Metallurgical and Chemical Research
Ore Testing
Analysis and Assaying
Box 430 — Phone 7
Lakefield, Ontario, Canada

LEDOUX & COMPANY, Inc.
Metallurgical Chemists — Assayers
Spectroscopists
Representatives of Shippers of Ores and Metals at Buyers Works
Mine Examination Analyses
359 Alfred Ave., Teaneck, N. J.

E. J. LONGYEAR COMPANY
Geological and Mining Consultants
Photogeology
76 So. Eighth St. Minneapolis 2, Minn.
Graybar Bldg. .. New York 17, N. Y.
Colorado Bldg. ..... Denver 2, Colo.
Shoreham Bldg. . Washington 5, D.C.
77 York Street .... Toronto, Ontario
129 Ave. De Champs-Elysees Paris, Fr.
Zeekant 35 ..... The Hague, Holland

Lottridge-Thomas & Associates
Professional Engineers
705 Judge Building
Salt Lake City 11, Utah

MERRILL W. MacAFEE
Consulting Engineer
Chemical-Metallurgical-Mining
7668 Santa Fe Ave.
Huntington Park, Calif.
LUdlow 3-1778
FRontier 5-6145

ARNOLD H. MILLER, INC.
Consulting Engineer
General Mine, Mill and Industrial Appraisals
Plant Design, Mechanization and Improvement
Cable: "ALMIL" Tel. Cortland 7-0635
120 Broadway, New York 5

JOHN D. MORGAN, JR. E.M., PH.D.
Consultant
Business and Defense Problems in Metals, Minerals, and Fuels
1091 Connecticut Ave., N.W.
Wash. 6, D.C.
ME 8-1681

MOTT CORE DRILLING COMPANY
Explorations, Test Borings
Mineral Prospecting
Pressure Grouting for Shafts-Tunnels
Large Diameter Holes
826-840 Eighth Ave.
Huntington 1, W. Va.

ARTHUR NOTMAN
Consulting Mining Engineer
55 Liberty St., 18th Floor
New York 5, N. Y., U.S.A.
Telephone BArclay 7-9484

O'DONNELL & SCHMIDT
Mining Consultants
165 Broadway — New York 6, N.Y.
BArclay 7-6960
Cables: EXAMINES

PENNSYLVANIA DRILLING COMPANY
Subsurface Explorations — Grouting
Industrial Water Supply
Mineral Prospecting
Large Diameter Drilled Shafts
Reports
1205 Chartiers Ave. Pittsburgh 20, Pa.

AMEDEE A. PEUGNET
Consulting Mining Engineer
Telephone MAin 1-1421
705 Chestnut St., St. Louis 1, Mo.

HOWARD G. SCHOENIKE
Consulting Mining Geologist
Examination—Evaluation—Exploration
Metallic and Nonmetallic Minerals
Domestic—Foreign
4039 Turnberry Cir.
Houston, Texas
Tel.: MO 5-7079

SMITH-EMERY CO.
Assayers and Chemists
SPECTROGRAPHIC ANALYSES
781 E. Washington Blvd.
Los Angeles 21, Calif.

Sprague & Henwood, Inc.
Drilling Service
Foundation Investigation, Test Boring
Group Hole Drilling and Pressure Grouting Diamond Core Drilling
251 W. Olive St., Scranton, Pa., New York, Phila., Pittsburgh, Atlanta, Ga. Grand Junction, Colorado, Buchans, Newfoundland

STILL & STILL
Consulting Mining Engineers and Geologists
24 Union Block—Phone 658
P. O. Box 1512
Prescott, Arizona

H. L. TALBOT
Extraction and Refining of Base Metals
Specializing in Cobalt and Copper
Consulting Metallurgical Engineer
Room 911, 209 Washington St.
Boston 8, Mass.

CONRAD WARD THOMAS
Registered Professional Engineer
Minerals Consultant—U.S. Foreign
• EXAMINATION-VALUATION
• MINERAL RAW MATERIALS
• DIVERSIFICATION
• FINANCING
Bank of the Southwest Building
Houston, Texas — CApital 7-5855

EARL C. VAN HORN
Consulting Geologist
Mining & Engineering Geology
Box 7, Tel. VE 7-2048, Murphy, N.C.

J. F. WHALEN
Mining Engineer
Exploratory Drilling - Grouting
Rock Breaking
Available for consultation on Exploration & Mining Problems
P.O. Box 4056 — Boise, Idaho
Phone 4-0098

WISSER AND COX
Geologists — Engineers
investigations & consultation
RESOURCES - EXPLORATION
OPERATIONS - VALUATIONS
INVESTMENTS - UTILIZATION
55 New Montgomery
YUkon 2-1436
San Francisco, California
cables: GEOLOG

HARRY J. WOLF
Mining and Consulting Engineer
Examination—Valuations—Management
One Park Place — New York 7, N. Y.
Cable: MINEWOLF
REctor 2-5307

COMPLETE CONSULTING AND MANAGEMENT SERVICES

MINERALS INDUSTRY—WORLD WIDE — **SPECIAL SERVICES LATIN AMERICA**

Geological — Mining — Milling — Mechanical — Metallurgical Services — Market Research — Property Appraisals
Diamond Drilling, Mine Development and Production Contracts — Mill and Metallurgical Test Work
Vertical Shaft and Slope Sinking — Newest Equipment — Design and Build Special Mining Equipment — Plants
Process Development — Ventilation Surveys by Expert
Capable Experienced Personnel for all Operations Available

ROGER V. PIERCE AND ASSOCIATES
Registered Engineers
808 Newhouse Building — **EMpire 3-5373** — **Salt Lake City, Utah**

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE

(Not available for Equipment Advertising) $1.50 a line. Minimum 3 lines. To figure advance payment count 5 average words as a line. (See 1 on Box Numbers.)

POSITION WANTED undisplayed rate is one half of above rate, payable in advance.

BOX NUMBERS count one additional line.

INFORMATION:

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

An ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

DISPLAYED RATE

The advertising rate is $16.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

EMPLOYMENT OPPORTUNITIES—$25.00 per inch subject to agency commission.

Send new ADS or Inquiries to Class. Adv. of Engineering & Mining Journal, P. O. Box 12, New York 36, N. Y., For September Issue Closing August 21.

MASTER MECHANIC

(British Guiana)

U.S. aluminum producer has opportunity for competent man to supervise electrical and mechanical maintenance. Must be familiar maintenance and repair open pit mining equipment, diesel electric generators, electrical distribution systems, etc. Previous overseas mining experience helpful but not essential. Prefer married man with no family. In letter give complete details on age, education and experience including types of equipment handled.

P-2281 ENGINEERING MINING JOURNAL

CLASS. ADV. DIV., P.O. BOX 12, N.Y. 36, N.Y.

MINING ENGINEER

With at least 5 years experience in engineering and mine supervision preferable in a trackless mining operation; experience in engineering measurements and contract calculations; conduct engineering studies, prepares engineering reports and mine cost reports; experience in sand-fill operation desirable; shaft operation, producing uranium ore; location, southwest. Send resume to G. E. Karr, Box 36, Grants, New Mexico.

MINING ENGINEER—INDIA

Mining Engineer (qualified) with some experience of hard rock mining required for long established Metalliferous Mine in India. Generous salary and allowances in keeping with experience. Agreement normally for three years, with leave on full pay after 2½ years service. First class passages of self and wife defrayed by the Company. Free furnished quarters, golf, tennis, swimming etc. Write in first place with full particulars birth, nationality, training and experience etc. to:

Box JY/73
c/o 95 Bishopsgate
London, E.C.2.

SENIOR PROJECT ENGINEER - DESIGN
Metallurgical-Chemical Plants
&
SENIOR POWER PLANT ENGINEER-ESTIMATOR

for permanent positions with one of the world's leading Engineering-Construction Companies. Headquarters in San Francisco P-2116 . . . Engineering & Mining Journal—68 Post St., San Francisco 4, California.

EXPLOSIVES SALES

Excellent opportunity for young graduate engineer wih explosives or mining experience to join the Industrial Chemicals Division of Spencer Chemical Company. The person selected will sell and promote the sale of prilled ammonium nitrate for its use as a blasting agent. This is a permanent position offering considerable opportunity to advance with an expanding organization.

In reply, please send resume of experience, education, age and salary requirements to:

Personnel Manager
Spencer Chemical Company
610 Dwight Building
Kansas City, Missouri

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Position Open—Operations Research Engineer—Medium sized nonmetallic processing plant—fine grinding and materials handling experience desirable. Should have training in mineral processing and minimum of five years experience. Northeast. Submit complete record. P-1840, Engineering & Mining Journal.

Mine Shift Boss for South American property. Knowledge of Spanish and previous Latin American experience preferred. P-2156, Engineering & Mining Journal.

POSITIONS WANTED

Mining Engineer 25 years experience in exploration development and operation of large and small mining enterprise. PW-9819, Engineering & Mining Journal.

Mining Engineer-Superintendent. Broad experience in exploration, development, mining and construction. Knowledge Government activities. Employed. PW-1443, Engineering & Mining Journal.

Mineral Dressing Engineer, B. Min. E., M. S., 33, 7 years experience, desires position in research or plant control. PW-2142, Engineering & Mining Journal.

Placer Engineer—Gold & Diamond alluvial specialist 18 years experience Canada, South America, Africa. Geophysical prospecting. Exploration, reports, development. Placer drilling, sluicing, dredging. Hars anti-suction and Denver jig specialist. Best references. Seek responsible position. Anywhere. PW-2210, Engineering & Mining Journal.

BUSINESS OPPORTUNITIES

Gypsum Deposit. 50,000,000 tons exposed strippable, Central Colo., near town, on RR and water. Albert Barlett. Wheatland, Wyo.

Gypsum Deposit, 80,000,000 tons strippable, Central Wyoming. Near town, on RR and water, natural gas available at field prices. Fine location for wallboard and plaster plant. Uranium, iron mines, oil fields, missile plants developing. Albert Barlett, Wheatland, Wyo.

(*Continued on following page*)

SILVER PROSPECTS WANTED

Responsible Producing Mining Company is looking for silver mine or prospect. No objection other metals. Details first letter please.

BO-1650 ENGINEERING & MINING JOURNAL
CLASS. ADV. DIV., P.O. BOX 12, N.Y. 36, N.Y.

DIRECTOR OF AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

ADELAIDE, SOUTH AUSTRALIA

The Research & Development Laboratories of the South Australian Department of Mines are to be reconstituted as the Australian Mineral Development Laboratories, and will be controlled by a Council representing the Mineral Industry, the Commonwealth Government and the Government of South Australia.

The Laboratories are installed in modern buildings in Adelaide and are well equipped for integrated mineral research, including analytical, mineralogical, chemical, metallurgical and chemical engineering investigations from bench to pilot scale. One of the prime functions of the Laboratories will be to perform mineral investigations for industry on a contract basis.

Present employees number 130, including 75 professional officers.

Applications are invited for the position of Director of this establishment.

Duties—Responsible to the Council for the direction and administration of the Laboratories. The successful applicant will have considerable freedom in the selection of research programmes.

Qualifications—A University degree in Engineering or Science. Wide experience in mineral investigation and research. Experience in plant design and operation would be an additional qualification. The ability to direct and inspire research staff in the mineral development field is essential. Administrative experience is desirable.

Salary—Adequate salary will be fixed by the Council. It will be not less than £A4,250 per annum. Appropriate superannuation benefits will be provided.

Term—The period of appointment will be a matter for discussion between the successful applicant and the Council.

Accommodation—The Council will assist the successful applicant in obtaining suitable accommodation.

Removal Expenses—First-class fares and reasonable removal expenses to Adelaide will be paid for the successful applicant and his family.

Applications will be treated as confidential and should be addressed to—

Australian Embassy,
1700 Massachusetts Avenue N.W.
Washington 6, D.C.

Closing date: 30th September, 1959

URANIUM-VANADIUM MILLING POSITIONS

Mechanical, Chemical and Extractive Metallurgical Engineers and Chemists with good qualifications and 0 to 6 years of experience to work in Colorado Operations. Send resume and copy of college transcript to:

Union Carbide Nuclear Company
Division of Union Carbide Corporation
Post Office Box 1049
Grand Junction, Colorado

CHECK THIS LIST FOR EXCELLENT BARGAINS

ASSAY EQUIPMENT
1—Pulverizer, 4" x 8", Model "F" Day, NEW
1—Balance, Ainsworth, Pulp
1—Balance, Ainsworth, analytical, in case
1—Balance, Braun-Knecht-Heiman, analytical, in case
1—Balance, Heusser Assay, 1/500 MG sensitivity
1—Dryer, BK 4, Size 13" x 13", 110 V
1—Furnace DFC 4411, Oil Fired

COMPRESSORS
1—500 CFM Gardner-Denver, HAC, 100 HP, 440V
1—975 CFM Xre, 175 HP, Sys. 2200 V.
1—1000 CFM Chicago Pneumatic, OCB, 200 HP, 440V
1—1050 CFM G.D., HA, 200 HP, G.E. 2200V
1—2000 CFM Worthington, 400 HP, 2300 V
1—2500 CFM Sullivan, WN4, 400 HP, West., 2200V
1—3000 CFM Ingersoll Rand PRE-2, 575 HP, 2200V

CLASSIFIERS
1—36" x 15'-0", Wemco, Model SCM, Spiral
1—45" x 17'-3", Akins Spiral w/drive
1—6' x 22' Dorr Duplex, Rake, w/5 HP
1—7' x 25'-6" Dorr DSFX, Rake Type

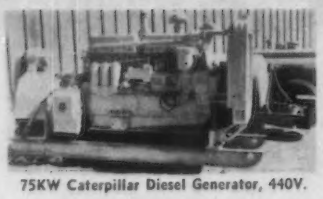
CARS, MINE ORE
18—18 cu. ft. C.S. Card, Z18, 18" ga.
20—20 cu. ft. C.S. Card, Z20, 18" ga.
11—30 cu. ft. C.S. Card, Rockerdump, 24" ga
32—35 cu. ft. Ajax Type, 18" ga.
25—60 cu. ft. C.S. Card, Granby, 30" ga.
32—37½ cu. ft. Ajax Type, 18" ga.
14—84 cu. ft. C.S. Card, Granby, 30" ga.
5—85 cu. ft. C.S. Card, Granby, 30" ga.
6—95 cu. ft. C.S. Card, Granby, 24" ga.
7—100 cu. ft. C.S. Card, Side Dump, 30" ga.
14—130 cu. ft. C.S. Card, Granby, 30" ga.

JAW CRUSHERS
1—8" x 10" Denver, Type H. New
1—8" x 24" Union Iron Works, 30 HP Motor
1—15" x 36" Universal, 50 HP, G. E. Motor
1—8" x 16" Cedar Rapids, Less Motor

CRUSHING PLANT
1—Pioneer, Model 40V, Portable, Complete

ENGINES, DIESEL
1—GMC, Model 671 RC, Elec. Start, PTO, 150 HP
1—Duetz, air cooled, Type A12L614, PTO, Excellent

ENGINEERING SUPPLIES
1—C. L. Berger Engineer Transit, 5" Circle, 11" Telescope, 3½" Compass



75KW Caterpillar Diesel Generator, 440V.

1—Berger Alidade, 8" Telescope, 4" Compass, Tripod & Table
1—Lietz Alidade Plane Table, 9½" Compass, Excellent Map Tables, Level Rods, Chains, Mechanical Drawing Machines.

FLOTATION MACHINES
1—1 cell Wemco, 44", 5 HP Motor
1—1 cell Denver, #18 Sp. 32" 3 HP Motor
4—2 cell Gallgher, 48", 15 HP Motor
1—2 cell Denver, #21, 38" x 38"
10—2 cell Fagregren, 56" x 56", 14 S.
1—5 cell Wemco, 44", 5 HP Motors
1—5 cell Denver #18 Sp. 32", 7½ HP
2—3 cell Fagregren 56" x 56", 14S.

GENERATORS, DIESEL
1—75 KW Caterpillar D 13,000 220/440 Volt, Diesel

HOISTS, SLUSHERS & TUGGERS
11—15 NNIG Ingersoll Rand, 2 drum, 220/440 V.
2—AAF212 Sullivan, 2 Drum, 15 H.P. 220/440 V.
1—C-111 Sullivan, 1 drum 40 HP, 220/440 V.
1—30 MNM 3D Ingersoll Rand, 3 drum, 30 HP, 220/440 V.
2—CF211 Sullivan, 2 drum, 50 HP, 440 V.
3—FF211 Joy, 2 drum, air
4—A4NNOJ, Ingersoll Rand, 2 drum air
4—HKE Gardner Denver, 2 drum, air
1—K4U Ingersoll Rand, 1 drum, air 3000#
5—HK Gardner Denver, 1 drum, air 2000#
7—HU, Ingersoll Rand, 1 drum, air, 2000#

HOISTS, MINE SHAFT
1—40 HP Coeur d' Alene Single Drum, Excellent
1—75 HP Puget Sound Single Drum
1—600 HP Vulcan Double Drum, 2300 V
1—500 HP Nordberg Double Drum, 22000# pull, 2300 V.
1—150 HP Vulcan Single Drum, 24,000# 150 FPM, 440 V.
1—400 HP CIR Double Drum, 20,000# at 1200 FPM.

LOCOMOTIVES
17—1½ Ton Mancha Battery, 18-24" ga.
3—1½ Ton Atlas, Type J, Battery, 18" ga.
1—2½-3 Ton Jeffrey, 18" ga.
1—3½ Ton Mancha Titan AX, 18" ga.
3—Universal Tramaire, Air, 18"-24" ga.

MUCKING MACHINES
2—12B Eimco, 24" ga. High or Low Decks
16—GD9 Gardner-Denver, 18"-24" ga.
1—HL3 Sullivan, 18" ga.
3—12B Eimco, 18" ga. Std. Decks
1—Eimco, Model 21, Mucking Machines, 18" ga.

MILLS
1—Complete Plant, 450 Ton Flotation, Complete w/ steel bldgs.

MILLS, ROD & BALL
1—3' x 8' Hendy Rod Mill, 30 HP
1—64½ Marcy Ball Mill, 100 HP
1—4' x 5' Colorado Iron Works, 30 HP
3—5' x 14' Marcy Ball Mill, 100 HP
1—6' x 16" Hardinge Conical Ball Mill, 50 HP
5—8' x 9' Traylor Ball Mills, 250 HP
1—5' x 8' Traylor Rod Mill, 150 HP

MOTORS, ELEC.
1—200 HP Westinghouse, Ind., 440 V, 580 RPM
1—200 HP G. E. Slip Ring Ind., 2200 V, 585 RPM
1—250 HP G. E. Slip Ring Ind., 2200 V, 585 RPM
2—300 HP G. E. Slip Ring Ind., 550 V, 514 RPM
2—375 HP G. E. Slip Ring Ind., 2200 V, 450 RPM

PUMPS
1—2" Oliver United Filters Centrifugal, 2" Suction
1—3" Byron Jackson, Centrifugal Water Pump, 40 HP, 440 V.
1—6" Weinman, Centrifugal, 1000 GPM, 140' Head, 100 HP, 440 V.
3—Allen Sherman Hoff Hydroseal Sand Pump, 4"
1—Ash Hydroseal Sand Pump, Rubber Lines, 2".
1—Denver Vertical Centrifugal Sand Pump, 1½".

WAGON DRILLS
11—FM2 Ingersoll Rand Wagon Drills, 8'
1—Model LM-57-LW-6A, Joy Wagon Drill, 6' Change.

Write For Complete Inventory Listings

PHONE WIRE WRITE

MACHINERY CENTER, INC.

1201 South 6th West P.O. Box 964, Salt Lake City 10, Utah Tel: HUnter 4-7601

FOUR HUNDRED YEARS AGO

Miners took out hard ore and rock without engines, drills, or explosives,
Pumped out shafts 900 feet deep with chains and horsehair,
Ventilated drifts a quarter mile long with bellows,
And smelted ores and separated metals in hand stoked furnaces.

HOW DID THEY DO IT?

The modern miner wants to know how they did so much with so little. And the old ways are fully explained in:

DE RE METALLICA

(Mining and Smelting Methods)
by Georgius Agricola

This remarkable book was published in 1556 in Latin, and was the "Moving the Earth" for the mining industry for over 200 years. It was translated into English in 1912 by ex-President Hoover and his wife, who added abundant footnotes and references. The original English edition has been out of print, reaching a price of $150 in the rare book market.
DE RE METALLICA is a complete, detailed guide to mining, smelting, and refining in the ages before explosives. This big beautiful edition, illustrated with all the original woodcuts, is a book you will be proud to own and to show to your friends.
672 pages 289 woodcuts $10.00

Satisfaction guaranteed. Returnable in 10 days for full refund or credit. C.O.D. orders filled.

NORTH CASTLE BOOKS
Dept. EJ
212 Bedford Road, Greenwich, Conn.

DIESEL ELEC. LOCOMOTIVES
3 New 25 Ton, 2 GE 1 Whitcomb
3—23 Ton, 2-45 Ton Used Gen. Elec.
1—44 Ton, 1-80 Ton Used Gen. Elec.
1—100 Ton, Also Used New 1955
3—100 Ton, Gen Motors 600 HP Used

MILL EQUIPMENT
3—Jaw Crushers—9"x21", 30"x36", & 56"x72"
Hardinge Mills 4'6"x16', 6'x48', 10'x48'
Rod Mills 5'x19' & 7'x15'
Ball Mills No. 56, No. 96, 7'x18' & 7'x35'
No. 3 WEMCO (HMS) Plant
Classifiers: 78"x36'6" Duplex, 84"x42' Spirals 8'x35'x16' Bowl-rake
Crushers, Fine Reduction: 22" Cone, 2' & 4¼' Cone, 37½ KVS
2—150 HP 1-200 HP S.D. Elec. Hoists
Rotary Dryers: 3'x20', 4'x20' and 5'x30'

R. C. STANHOPE INC.
60 E. 42nd St., N. Y. 17, N. Y.

BUSINESS OPPORTUNITIES

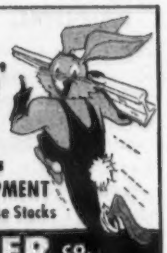
(*Continued from Preceding Page*)

For Sale Gold Mine—High Grade Gold Vein ¾ ounce ton gold average heads to 35 ton modern flotation mill all diesel-Electric. Outcrop 300 feet above extraction tunnel. 500 feet ore shoot developed. 150 acres clear titled claims. Mine mill operating. Nearby hold high grade silver-lead-zinc property. Produced 40 million ounces silver by government records up to 1910. Landing field, telegraph service truck road. Delightful climate located in state of Durango, Northern Mexico. Replies to BO-2253, Engineering & Mining Journal.

840 acres proven manganese lands in heart of Batesville-Cushman quadrangle. In production now. Make offer. Write Bee Vanemburg, Owner, Batesville, Arkansas.

For Sale, Gold and copper mine one million tons blocked out, reports sent on request, and bank reference. P.S.—320 acres of farming land included. Box 384, Yerington, Nevada.

Excellent exploration opportunity. Vehicle expenses needed by experienced mining geologist to continue prospecting for copper in Arizona with new geochemical method proven reliable in locating covered ore bodies. BO-2214, Engineering & Mining Journal.



"FASTER FROM FOSTER"
RAIL
& ALL TRACK EQUIPMENT
Nation's Largest Warehouse Stocks
L. B. FOSTER CO.
PITTSBURGH 30 • ATLANTA 8 • NEW YORK 7
CHICAGO 4 • HOUSTON 2 • LOS ANGELES 5

CARBIDE INSERT JACKBITS
2¼" Timken "D" thread. One center and two side holes.
SACRIFICE PRICE
JULIUS M. FOGELMAN,
1649 Perkiomen Ave., Reading, Penna.

WIRE US COLLECT!

ROTARY DRYER
Standard Steel 5' x 47' 5/16" welded steel. Complete with fire-box burner, cyclones and fans. 15 HP gear head motor.
PRICED TO SELL
Wire or phone collect—GA 1-1380
ME MACHINERY AND EQUIPMENT CO.
123 Townsend St. - San Francisco 7, Calif.

WORLD WIDE SIGN OF DEPENDABILITY

SINCE 1898 MORSE BROS. HAS BEEN SERVING THE WORLD'S MINING INDUSTRY WITH DEPENDABLE, RECONDITIONED, ECONOMICAL EQUIPMENT

JAW CRUSHERS
5—2½" x 3½" New Morse Lab Crushers
5—4" x 6" New Morse Lab Crushers
2—5" x 8" New Morse Jaw Crushers
1—6½" x 7" Hendy Jaw Crusher
1—10" x 20" Pacific Jaw Crusher
1—9" x 16" Kue-Ken #30 Balanced Jaw Crusher
1—20" x 36" Diamond Roller Bearing Jaw Crusher.

FLOTATION MACHINES
1—29" Fagergren Single Cell
1—36" Fagergren Single Cell
1—38" Morse-Weinig 2 Cell
1—27 Morse "Jetair" Hydracell 22" x 22"
1—4-cell Morse-Weinig, 24" x 24"
1—6-Cell Stearns-Roger 31" Cells
1—6-Cell Fagergren 36" Cells
1—2-cell Fagergren, 66"
1—6-cell Denver #21, 38" x 44"
1—4-cell Denver #21, 38" x 44"

BALL AND ROD MILLS
1—4' x 4' Hersch Ball Mill
1—4' x 4' Marcy Ball Mill
1—6' x 4' Hardinge Conical Ball Mill
1—64½ Marcy Ball Mill
1—8' x 22' Hardinge Conical Ball Mill
1—5' x 7' Morse New Rod Mill
1—5' x 10' Allis Chalmers Rod Mill

MINE HOISTS—SINGLE DRUM, ELECTRIC
1—10-HP Vulcan #0
1—15-HP Vulcan
1—20-HP H&B
1—25-HP Vulcan #1½
1—30-HP Vulcan #22D
2—40-HP Vulcan
1—50-HP H&B
1—50-HP W. A. Box
1—75-HP Vulcan
1—100-HP W. A. Box
1—112-HP Vulcan
1—150-HP Vulcan
1—150-HP Ottumwa
1—250-HP Ottumwa

MINE HOISTS—DOUBLE DRUM, ELECTRIC
1—75-HP H&B Complete with Steel Headframe
1—75-100 HP, Clutched Drums, Post Brakes
1—82-HP Vulcan #5½
1—100-HP Webster, Clamp & Lane
1—150-HP Jackson

LOADERS
2—Eimco 12B, 18" ga.
1—Joy HL20, 24" ga.

AIR TUGGER HOISTS
8—Ingersoll-Rand Model EUA
2—Ingersoll-Rand Model 10HR
5—Gardner-Denver Model HK
2—Joy Model F113
3—Ingersoll-Rand Model HU
2—Ingersoll-Rand Model 10H
1—Sullivan Model HA3
4—Ingersoll-Rand Model 1H
1—Ingersoll-Rand Model DU
1—Sullivan Model L-111
3—Ingersoll-Rand Model D6U

ELECTRIC TUGGER HOISTS
1—5-HP Sullivan, Single Drum, Model DE
2—7½-HP Sullivan, Single Drum, Model HE
4—5-HP Sullivan, Double-Drum, Model HDE
1—15-HP Ingersoll-Rand, Double Drum, Model 15NN-16
1—30 HP Joy double drum Slusher class B-212
1—60 HP Sullivan 3 drum Slusher class CF-312

GYRATORY CRUSHERS
1—7' Traylor Type TY Gyratory
1—2' Symons Standard Cone Crusher

CONCENTRATING TABLES
9—Deister #6 super duty standard size concentrating tables
8—Dunham "Economy Type" concentrating tables, 50" x 11'9" decks

VIBRATING SCREENS
1—3'x6' Robins Single Deck
2—4'x6' Allis Chalmers Single Deck
1—4'x8' Robins Double Deck
1—4' x 12' Seco Double Deck

DIESEL GENERATORS
1—15 KW Waukesha-Century
1—30 KW Buda-Century
175—KVA Caterpillar D-13,000-General Electric
1—112.5 KVA Caterpillar D17,000-General Electric
1—250 KVA Buda-General Electric

MINE CARS
7—15 cu. ft. End Dump 18" ga.
4—18 cu. ft. End Dump 18" ga.
6—18 cu. ft. Card Rocker Dump 18" ga.
3—20 cu. ft. Card End Dump 18" ga.
38—20 cu. ft. Rocker Dump 18" ga.
2—25 cu. ft. Card End Dump 24" ga.
3—26 cu. ft. Card Granby Type 24" ga.
11—28 cu. ft. Morse Bros. Side Dump 24" ga.
6—34 cu. ft. Koppel Rocker Dump 36" ga.
10—84 cu. ft. Truax Rocker Dump 36" ga.
18—124 cu. ft. Granby Type 24" ga.

SKIP CARS
1—30 cu. ft. Card 24" ga.
1—50 cu. ft. Card 42" ga.

DIAPHRAGM PUMPS
1—2" Wemco Simplex
1—2" Deco Simplex
1—3" Dorrco Duplex
1—3" Wemco Simplex
1—3" Dorrco Simplex
1—4" Dorrco Simplex
2—4" Butchart Simplex
1—4" Carter Simplex Portable Gas Engine Driven
3—6" Dorrco Duplex

DIESEL ENGINES
1—D8,800 Caterpillar 4 cyl. 98 HP
1—D13,000 Caterpillar 6 cyl. 125 HP
1—450 HP Buda 8 cyl. Model 8DCS2505

SEND FOR NEW CATALOG #591-E **COMPLETE ILLUSTRATED STOCK LIST**

MORSE BROS. MACHINERY CO.

EST. 1898

2900 Brighton Blvd. P. O. Box 1708 Keystone 4-5261 DENVER, COLORADO

FOR SALE

KILNS—DRYERS
1—7'6" x 60' Kiln, ¼" welded shell.
1—11'x155' Traylor kiln, ⅜" shell, (2) tires.
1—8'x115' kiln, ½" shell, (2) tires.
1—7'6"x100' Kiln, ½" shell.
4—8'8"x70' Hardinge dryers, #XA-18.
1—7'x50' Allis-Chalmers dryer, ½" shell.
1—6'x50' Louisville rotary dryer.
15—Rotary dryers: 5'6"x50', 4'9"x33', 4'6"x40', 4'x12', 3'x15', 2'x9'.

MILLS—CRUSHERS
1—Kennedy 4'x8' rod, 50 HP., end per. ditch.
1—Hardinge 4'6"x16" conical ball mill, 25 HP.
4—Allis-Chalmers 5'x22' ball-tube, 150 HP.
1—Allis-Chalmers 6'x16' ball-tube.
1—Marcy 7'x15' rod, 300 HP, 4" liners.
3—Jaw Crushers: 20"x6", 18"x9", 36"x15"
1—Kennedy gyratory crusher, #49-S, 100 HP.

PERRY EQUIPMENT COMPANY
1419 N. 6th St., Phila. 22, Pa.
POplar 3-3505

RUBBER PRODUCTS for IMMEDIATE DELIVERY

CALL, WIRE or WRITE
CARLYLE
THE
RUBBER HEADQUARTERS

LOW PRICES, DEPENDABLE QUALITY FOR 40 YEARS

WHAT EVER YOUR RUBBER NEEDS ARE ! !

AIR HOSE	HYDRAULIC HOSE
WATER HOSE	OIL HOSE
SUCTION HOSE	WELDING HOSE
DISCHARGE HOSE	VACUUM HOSE
STEAM HOSE	SAND SUCTION HOSE
PILE DRIVER HOSE	DREDGE SLEEVES

CONVEYOR BELTING
ELEVATOR BELTING
"V" BELTS

Write for complete catalogue

CARLYLE RUBBER CO., INC.
103-107 WARREN ST. Digby 9-3810 NEW YORK, N. Y.

PIPE
500,000 ft 10¾" 40#. 250,000 ft 8⅝" 28½ lb.
All machine cleaned, straight. Plain end. coated Strickley No. 1. Pittsburgh Test. Lab. report furnished.
Immediate delivery.
Indiana-Ohio Pipe Co.
P.O. Box 323, Phone 34674, Decatur, Ind.

NEW RAIL
20# — 30# — 40#
IN STOCK
LEFTON INDUSTRIAL CORP.
GENERAL OFFICE: 212 Victor St.
St. Louis 4, Mo.

6' x 60'—7½' x 50'—8' x 60' & 8½' 65' dryers.

CRUSHERS:
1—48" x 6", 42" x 40", 24" x 36", 18" x 36", 12" x 24" Jaw Crusher
2—42" x 16" Allis-Chalmers Crushing Rolls
6", 10", 30" McCully Super Gyratory Crushers
No. 3 up to No. 12 Gyratory Crushers
Complete lime hydrating plant.

BALL & TUBE MILLS:
5' x 22' & 6' x 22' & 7' x 24' Tube Mills
3 T. P. H. & 5 T. P. H. rebuilt lime hydrators
We make new kilns & dryers.

W. P. HEINEKEN, INC.
50 Broad St., WH 4-4236 NEW YORK 4, N. Y.

ADDITIONAL "SEARCHLIGHT" ADVERTISING
on following page

SALE OR RENT
1—1975 CFM Worthington DYC direct connected to 350 HP Sync. Motor—New 1954
3—25 & 45 Ton Diesel Electric Locomotives
1—30 Ton Browning Diesel Locomotive Crane
1—D17000 Caterpillar Power Unit
B. M. WEISS COMPANY
Girard Trust Bldg. Philadelphia 2, Pa.

ADVERTISERS IN THIS ISSUE

***Indicates more product information may be found in company advertising appearing in E&MJ June 1959 Mining Guidebook and Buying Directory Issue. Check your Guidebook Index.**

*Acme Hamilton Mfg. Corp. 30
*Aero Service Corp. 123
*Alemite Div., Stewart-Warner Corp. 53
*Allen-Sherman-Hoff Pump Co. ..... Second Cover
*Allied Chemical Corp., General Chemical Div. 167
*Allis-Chalmers 38-39, 67, 118, 147
*American Brattice Cloth Corp. 170
*American Cyanamid Co. 17
American Institute of Mining, Metallurgical & Petroleum Engineers 166
*American Steel Foundries 41
*Atlas Copco 139
*Atlas Powder Co. 15
*Autocar Div., The White Motor Co. 40

*Bethlehem Steel Co. 65, 141
*Birdsboro Steel Foundry & Machine Co. 126
*Blaw-Knox Co. 74
*Boston Woven Hose & Rubber Co. 159
*Broderick & Bascom Rope Co. 57

*Card Iron Works, C. S. 156
*Case Co., J. I. 171
*Caterpillar Tractor Co. 5, 51, 158
*Chicago Pneumatic Tool Co. 36-37
*Christensen Diamond Products 27
*Clark Equipment Co. 12
*Connellsville Mfg. & Mine Supply Co. 148
Crane Co. 169

*Deister Concentrator Co. 142
Denver Equipment Co. 111
*Detroit Diesel Engine Div., General Motors. 32
*Diamond Drill Contracting Co. 154
*Diamond Tool Research Co. 166
*Differential Steel Car Co. 146
*Dorr-Oliver, Inc. 8-9
*Ducon Co. 70
duVerre, Inc. 121

*Eimco Corp. 58, 119
*Ellicott Machine Corp. 121
*Ensign-Bickford Co. 49
*Equipment Engineers, Inc. 157
*Euclid Div., General Motors 16
*Exide Industrial Div., Electric Storage Battery Co. 120

*Falk Corp. 6
*Ford Motor Co., Truck Div. 62-63, 135

*Gardner-Denver Co. 18
*General American Transportation Corp. 161
General Electric Co. 130-131
General Electric Co., Wire & Cable Dept. 163
*General Tire & Rubber Co. 73
*Goodrich Industrial Products Co., B. F. 3
*Goodrich Tire Co., B. F., A Div. of B. F. Goodrich Co. 107
*Goodyear Tire & Rubber Co., Metal Products Div. 11

*Hardinge Co. 164

*Industrial Physics & Electronics Co. 168
*Ingersoll-Rand 1
*International Harvester Co. 75, 76-77, 78-79
*International Nickel Co. 132

*Joy Mfg. Co. 13, 170

*KW-Dart Truck Co. 68
*Kaiser Engineers Div., Henry J. Kaiser Co. 151
*Kennedy-VanSaun Mfg. & Engrg. Corp. 34

*LeRoi Div., Westinghouse Air Brake Co. 14
*LeTourneau-Westinghouse Co. 29, 31, 33
*Lectromelt Furnace Div., McGraw-Edison Co. 72
*Lima Construction Equipment Div., Baldwin-Lima-Hamilton 129
*Linatex Corp. of America 121
*Link-Belt Co. 69
*Lubriplate Div., Fiske Bros. Refining Co. 168

*Mack Trucks, Inc. 143
Magnaflux Corp. 167
*Magor Car Corp. 150
*Mancha Locomotive Div., Goodman Mfg. Co. 46
*Marion Power Shovel Co. 155
Michigan Chemical Corp. 154
*Mine & Smelter Supply Co. 54-55
*Mine Safety Appliances Co. 117
*Minneapolis-Honeywell 52
*Mission Mfg. Co. 109
*Mixing Equipment Co., Inc. 66

*National Iron Co. 28
*New York Engineering Co. 170
*Nordberg Mfg. Co. 71

Ohio Brass Co. 165
Okonite Co. 153

PLM Products, Inc. 140
Peterson Filters & Engrg. Co. 138
*Philadelphia Gear Corp. 149
*Philadelphia Quartz Co. 167
*Porter Co., Inc., H. K., Thermoid Div. 136

*Ridge Tool Co. 128
*Roebling's Sons Corp., John A. 145
*Roots-Connersville Blower Div., Dresser Industries, Inc. 35

*Sauerman Bros. 127
Searchlight Section 172-175
*Sprague & Henwood, Inc. 158
*Standard Oil Co. of California 7
*Standard Steel Corp. 160
*Stearns Magnetic Products, A Div. of The Indiana Steel Products Co. 124
*Stoody Co. 137
*Sturtevant Mill Co. 162

Tennessee Corp. 160
*Texaco Co., Inc. 10
*Texas Gulf Sulphur Co. 59
*Timken Roller Bearing Co. ..... 42, Fourth Cover
*Traylor Engrg. & Mfg. Co. 56
*Turbo-Mixer Div. of General American Transportation Corp. 161
*Tyler Co., W. S. 152

*United States Rubber Co. (Mech. Goods Div.) 105
*United States Steel Corp. 60-61

*Wedge-Wire Corp. 122
*West End Chemical Co. 125
*Western-Knapp Engrg. Co. 113
*Wheel Trueing Tool Co. ..... Third Cover
*Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp. 50
*Wild Heerbrugg Instruments, Inc. 133
*Wilfley & Sons Co., A. R. 80

●

PROFESSIONAL SERVICES 172
CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.
EMPLOYMENT OPPORTUNITIES 173

●

BUSINESS OPPORTUNITIES 173-174
PROPERTY
For Sale 173-174
EQUIPMENT
(Used or Surplus New)
For Sale 174, 175, 176

ADVERTISING SALES STAFF

Atlanta 3 ..... M. H. Miller, 1301 Rhodes-Haverty Bldg., Jackson 3-6951
Chicago 11 .. G. A. Mack, F. W. Roets, 520 N. Michigan Ave., Mohawk 4-5800
Cleveland 13 ..... J. E. Lange, Illuminating Bldg., 55 Public Square Superior 1-7000
Dallas 1 ..... P. B. Holland, 1712 Commerce St., Riverside 7-5117
Denver 2 ..... J. W. Patten, Mile High Center, 1740 Broadway, ALpine 5-2981
Los Angeles 17 .. J. B. Uphoff, 1125 W. 6th St., Huntley 2-5450
New York 36 .. H. O. Chellson, R. W. Peckham, 500 5th Ave., Oxford 5-5959
Pittsburgh 22 ..... Wm. H. H. Ginder, 1111 Oliver Bldg., Atlanta 1-4705
Philadelphia 3 ..... J. B. Lewis, 6 Penn Center Plaza, Locust 8-4330
St. Louis 3 ..... F. W. Roets, Continental Bldg., 3615 Olive St., Jefferson 5-4867
San Francisco 4 ..... J. W. Otterson, 68 Post St., Douglas 2-4600
EUROPE ..... Michael R. Zeynel
85, Westendstrasse, Frankfurt/Main, Germany
McGraw-Hill House, E. E. Schirmer, 95 Farringdon St., London, E.C. 4

REVOLVING GANTRY CRANE: 22 ton cap., 95' boom, 16' track gauge, 13' portal clear, 440 volt, 3 phase, 60 cycle.

LOCOMOTIVES: Standard Railroad Gauge:
2—20 H.P., Gas and Diesel.
2—25 H.P., Gas and Diesel.
1—600 H.P., four 1000 H.P. General Motors and Alco Diesel Electric Road Switchers.

OVERHEAD ELECTRIC TRAVELING CRANE: 180 ton capacity, 65 ft. span, 240 volt DC.

JAW CRUSHERS: 18 x 30 and 30 x 42 sectionalized for underground use; 40 x 42, 48 x 60 and 56 x 72, all steel, with or without motors and controls.

CRUSHING & SCREENING PLANT: Telsmith 48" Gyrasphere with 100 H.P. motor, V-Belt drive, with 5 x 12 triple deck screen, 30" x 69' feeder conveyor, one 30" x 40' rock return conveyor, with or without 36" x 6' reciprocating plate feeder, 24" and 30" portable conveyors.

HARDINGE CONICAL BALL MILLS: 8 x 36 and 8 x 48 complete with 2200 volt motors.

BELT CONVEYOR: 42" x 850 ft. complete with all mechanical and electrical parts, with or without belt.

HOISTS: Lidgerwood single drum 7' dia., 5'3" face, 32,000 lbs. pull, 1⅜" rope, 250 or 450 FPM, 150 or 250 H.P. One single drum Nordberg 5' dia., 5' face, 1¼" rope, 100 H.P., 750 FPM. One Nordberg double clutched drum 10' x 10', 1¼" rope, 1250 H.P., 1200 FPM. All the above with post brakes, Lilly controls, 2200 volt motors and controls. Other hoists 100 H.P. to 2500 H.P.

MOTORS & CONTROLS for Mine Hoist Duty as follows: 150, 250, 450, 600, 1200, 1400, and 1500 H.P.

WE BUY AND SELL EQUIPMENT THROUGHOUT NORTH AND CENTRAL AMERICA

A. J. O'NEILL

Lansdowne Theatre Building
Lansdowne, Pa.

Phila. Phones: MAdison 3-8300—3-8301

14 – 60E Joy

SHUTTLE CARS

250 V., D.C.

These are good rugged cars and in good condition. They have disc brakes and elevating discharge. These cars are available for your immediate inspection at our Clarksburg, W. Va., yard. For more information on these cars, or any other equipment needs, contact one of our representatives at either of our offices.

ELECTRIC AND MACHINE SUPPLY COMPANY

Whitesburg, Kentucky
P. O. Box #610
Phone #2223

Clarksburg, West Va.
P. O. Box #227
Phone #MA 3-0253

MANUFACTURING AND SERVICE FACILITIES

DETROIT
WINDSOR
DALLAS
PARIS
MILAN
MEXICO CITY
BASINGSTOKE
FRANKFURT
JOHANNESBURG

TRUCO®
DIAMOND BITS

WHEEL TRUEING TOOL COMPANY

3200 W. DAVISON AVENUE • DETROIT 38, MICHIGAN

Member DIAMOND CORE DRILL MANUFACTURERS ASSOCIATION

WABI reports: "Cars take sharp underground curves ...TIMKEN® bearings take the thrust, cut maintenance costs"

SHARP curves on this underground railroad put heavy thrust loads on the mine car wheels. To take the thrust, keep the 2,300 lb. cars hauling their two-ton loads steadily with minimum maintenance, Wabi Iron Works Ltd. mounts the wheels on Timken® tapered roller bearings. (See diagram right.) Timken bearings *roll* the load . . . assure users of Wabi mine cars longer bearing life and trouble-free operation. Here's why:

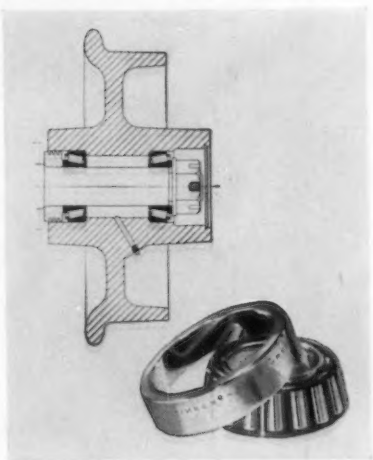
1) *The tapered design* of Timken bearings lets them carry both radial and thrust loads, or any combination.

2) *Extra load-carrying* capacity with Timken bearings because of the full-line contact between rollers and races. And their incredibly smooth surface finish gives practically friction-free rolling.

3) *The bearing's heart*—the steel—is the finest. We make it ourselves to be sure.

4) *Holding shafts concentric* with their housings, Timken bearings make closures more effective—keep dirt out, lubricant in.

To make the machines you build or buy better, equip them with Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*



BETTER-NESS rolls on

TIMKEN®

tapered roller bearings

First in bearings for 60 years